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3000-HP ROLLER GEAR TRANSMISSION DEVELOPMENT PROGRAM. VOLUME IV. LABORATORY BENCH TEST

G. F. Gardner, et al

United Aircraft Corporation

Prepared for:

Army Air Mobility Research and Development Laboratory

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3000-HP ROLLER GEAR TRANSMISSION DEVELOPMENT PROGRAM

Volume IV - Laboratory Bench Test

G. F. Gardner, R. E. Haven
Sikorsky Aircraft
Division of United Aircraft Corporation
Stratford, Connecticut 06602

May 1974

Final Report

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EUSTIS DIRECTORATE
U. S. ARMY AIR MOBILITY RESEARCH AND DEVELOPMENT LABORATORY
Fort Eustis, Va. 23604

EUSTIS DIRECTORATE POSITION STATEMENT

This report is one of six volumes of the final report under this contract. The objective of this program is to conduct research on the feasibility of a high-reduction ratio roller gear transmission of 3000 horsepower through experimental flight test. This report covers the 200-hour laboratory or bench test phase of the overall program. The roller gear unit is the 20:1 output stage of a growth S-61 type main transmission.

Laboratory back-to-back testing results indicated that the roller gear unit proved that it would perform for extended periods of time in the fatigue environment of a helicopter transmission. The major problems encountered in the earlier phases of testing were related to electron beam welding rather than to the roller gear concept. Specific details on the approach to solutions of the manufacturing problems with electron beam welding are presented in a separate final report of this contract.

The technical monitors for this contract were Messrs. James Gomez and Leonard M. Bartone, Technology Applications Division.

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This report presents the results of dynamic load tests performed on a helicopter transmission which incorporates a roller gear drive unit as the main reduction stage. The primary purpose of this program was to conduct a 200-hour endurance test at 100 percent design speed and at a load spectrum equivalent to military helicopter usage.

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The transmission speed reduction from dual inputs operating at 18,966 rpm to the main rotor shaft speed of 203 rpm is via an input bevel mesh, combining spur gear reduction mesh and a 20:1 roller gear reduction output stage. Maximum operational input power is 1870 hp per input with the roller gear unit rated for 3000 hp.

The 200-hour endurance test was successfully completed after some design modifications to the roller gear assembly components. The changes, resulting from fractures originating at electron beam welded joints, were incorporated during initial development tests which preceded the 200-hour endurance test. Included in the transmission test program was a no-load lubrication test, a gear pattern development test, and an efficiency test.

Testing was primarily conducted in a regenerative test stand wherein two identical transmissions are coupled in a closed power path. An instrumentation system continuously monitored loads, speed, temperatures, oil flows and pressures. A chip detection system integral within the transmission provided warning of incipient failure.

The tests showed that the efficiency of the roller gear transmission is comparable to that of high reduction two-stage planetary transmissions of conventional design, and that the roller gear unit could perform for extended periods of time in the fatigue environment of a helicopter transmission.

The tests performed showed that the roller gear drive is a feasible reduction unit for helicopter main transmissions.

PREFACE

This report presents the results of a bench test development program to determine the feasibility of utilizing a high reduction ratio roller gear drive in a turbine-powered helicopter transmission system. The program was conducted at Sikorsky Aircraft for the Eustis Directorate of the U. S. Army Air Mobility Research and Development Laboratory, under Contract DAAJ02-69-C-0042 (Task 1G162203D14414). This contract resulted from a proposal submitted in March 1969 by Sikorsky Aircraft to conduct a two-phase program to design, fabricate and bench test a roller gear unit in a helicopter transmission (Phase I), and to ground test and flight test this transmission on an S-61 helicopter (Phase II). The bench test portion of this program was conducted under the cognizance of Mr. J. Gomez and Mr. L. Bartone, USAAMRDL representatives.

Acknowledgement of appreciation for technical assistance must be extended to Mr. A. Kornmann of The Buehler Corporation. (Mr. D. Cozens, deceased, from The Buehler Corporation, also assisted.) Technical assistance was provided by Messrs. D. Wilson and R. Haven of Sikorsky Aircraft, Mechanical Test Section; and P. Marinaccio and G. Gardner of Sikorsky Aircraft, Transmission Design Group. Technical contributions were provided by Messrs. J. Bucci, K. Cormier, and J. Kish of Sikorsky Aircraft. Mr. L. Burroughs is the program manager for the overall roller gear program.

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INTRODUCTION

With the advent of the improved turbine power plants and with the demand for better performance, it has become necessary to provide helicopters with lighter, more efficient, and more reliable transmissions. One of the more interesting results of this search for improved transmissions has been the development of the roller gear drive transmission.

The roller gear drive is, basically, the combination of a planetary gear train with a roller traction drive. The rollers, besides contributing to the transmission of torque through rolling friction, provide the sole support for the planetary components. The only bearings needed for this type of gearbox are in the last row of pinions to react the torque through the system. If the roller gear drive is properly designed, these bearings react only tangential loads, not radial loads.

Development of the roller gear drive began in 1963 with a parametric study of the concept at TRW, Inc. This study examined the applicability of the roller gear drive principle to helicopter power trains. Various basic designs were examined to assure that no obstacles would preclude the use of the roller gear drive in helicopter transmissions. The possible effects on helicopter drive trains were also examined considering only state-of-the-art design methods and materials. The conclusion of this study was that the roller gear drive appeared to be superior to conventional planetaries with respect to weight, reliability, vibration life and efficiency.

Development work at TRW, Inc., continued in 1964 and 1965 with the design, fabrication, and testing of a roller gear power transmission capable of accepting 200 horsepower loads at 28,000 rpm. This transmission was tested for over 1000 hours in a regenerative test stand at TRW under the direction of Dr. Nasvytis. The successful completion of this test, with gearbox efficiencies running 98 percent and better, indicated that the roller gear drive was indeed a potentially valuable addition to helicopter transmission technology. It remained, however, to test a roller gear drive transmission at powers more representative of actual aircraft conditions.

In 1968 and 1969, the Bell Helicopter Company of Fort Worth, Texas, conducted an engineering design study to determine the feasibility of employing the roller gear concept in a transmission for the UH-1 helicopter. This study, which compared the roller gear drive to the existing UH-1 transmission and a new three-stage planetary design, showed that in the areas of efficiency and reliability the roller gear drive was the potentially superior design. The roller gear drive ranked last only in fabricability/cost of the areas examined, while

ranking second to the new three-stage planetary in weight. Meanwhile, TRW had proceeded to design and fabricate an 1100 hp roller gear drive unit for the U. S. Army Aviation Materiel Laboratories. This transmission, which converted an input speed of 21,000 rpm to an output speed of 325 rpm, was then tested in a regenerative test facility. The transmission logged 76.5 hours of testing before failures due to design deficiencies in roller gear components caused cessation of the test short of the 200-hour target. While this program was not an unqualified success, certain results, particularly efficiency, were especially encouraging, and the program did serve to delineate some of the difficult problems associated with the design and manufacture of a roller gear unit.

Sikorsky Aircraft became involved with the roller gear drive with a feasibility study, in 1966. This study examined the potential application of a roller gear drive to the CH-54 helicopter main transmission. While this study concluded that the roller gear drive was not feasibly applicable to this particular aircraft, it was this study and subsequent independent research and development studies into the roller gear drive by Sikorsky Aircraft which led to the present roller gear program for the S-61 aircraft.

Sikorsky Aircraft under contract with the Eustis Directorate of the U. S. Army Air Mobility Research and Development Laboratory is conducting a program involving the design, fabrication, and testing of a roller gear transmission for use with the Sikorsky Aircraft S-61 helicopter. This report covers the bench test segment of that program.

Under the bench test program, a total of five tests were performed:

1. No-Load Lubrication Test
2. Gear Pattern Development Test
3. Initial Development Test
4. 200-Hour Endurance Test
5. Efficiency Test

Inspections of the roller gear transmission were performed at the conclusion of each of these tests except the efficiency test which was performed coincidentally with the 200-hour endurance test. A complete teardown and inspection of the roller gear transmission was performed at the conclusion of the 200-hour endurance test.

Included in this report are discussions of the procedures and facilities used for these tests as well as the results of inspections. The results of the tests and conclusions drawn from them are also presented. Brief discussions of the design and manufacture of the roller gear transmission are also included.

TRANSMISSION DESIGN

The roller gear drive consists of a roller friction drive compounded with a gear drive in a planetary or epicyclic arrangement. Earlier studies of feasibility and performance parameters by TRW, Bell, and Sikorsky (References 1, 2, 3 and 4) indicated that numerous advantages could be gained through the use of a roller gear drive in a helicopter transmission. Among these are improved efficiency, improved reliability, reduced height, reduced weight, and reduced gear noise.

Of primary importance to the operation of a roller gear drive unit such as that designed for the S-61 transmission shown in Figure 1 is the integration of rollers with the gears of the planetary gear train. These rollers, located on either side of the gear, have outside diameters coincident with the pitch diameters of the gears. Besides contributing to the transmission of torque through friction, these rollers support the gears in the optimum mesh position, i.e., parallel to each other at the pitch diameters. Parallel operation of gears at their pitch diameters is always desirable because in that position sliding friction is minimized, load is most evenly distributed, and contact is made across the greatest percentage of face width. With conventional means of support, positioning gears parallel to each other for operation at their pitch diameters is often difficult because of differential thermal expansion, manufacturing tolerances, and shaft deflections. These factors are eliminated or minimized with the roller gear drive.

Because of the use of rollers for support, conventional bearings are eliminated in all but the last row pinions where they are necessary to react the torque through the planetary system. A twofold saving of weight results from the elimination of the bearings. First, the total weight of the extra rolling surfaces on the gear cylinders is less than the corresponding bearing and bearing shaft weight. Second, the elimination of the bearings permits the use of the smallest gears compatible with load carrying ability. In conventional planetaries, the use of larger gearshafts is sometimes necessary to accommodate larger bearings needed to react shaft loads. In addition, the roller gear drive eliminates the centrifugal forces induced on bearing rollers or balls, making the roller gear design one of inherently longer life.

For the roller gear transmission development program, Sikorsky Aircraft chose its S-61 helicopter as the vehicle for which this advanced transmission was to be designed. This helicopter, which is in service commercially and with the Navy, Air Force, Coast Guard, Foreign Military, and U. S. Presidential Squadrons, is shown configured for the roller gear transmission in Figure 2. The design requirements for the roller gear transmission,

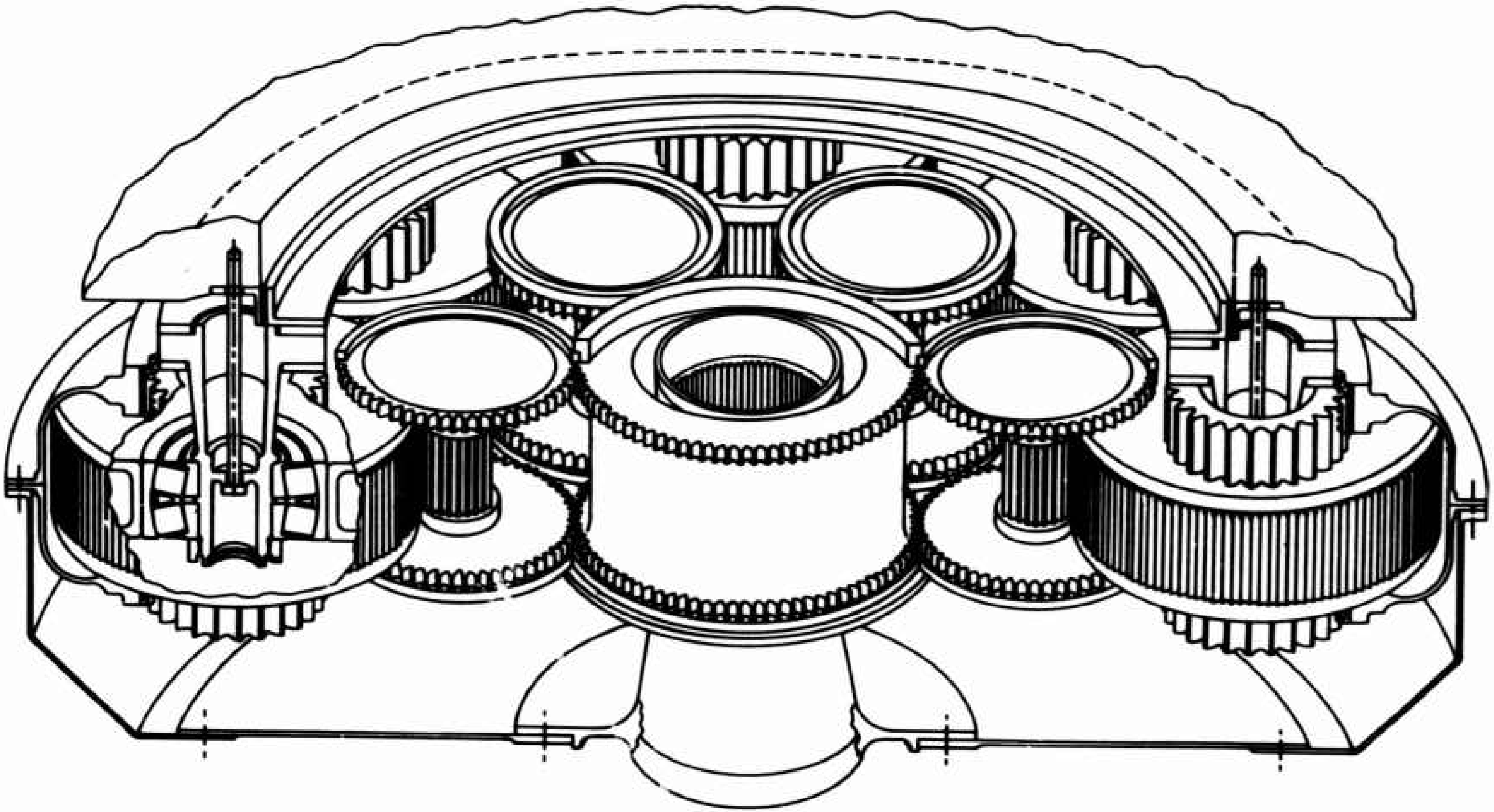


Figure 1. Roller Gear Drive Schematic.

Figure 2. S-61 Configured for Roller Gear Transmission.

outlined in Table I, are for a 27,000-pound gross weight growth version of the S-61. Design parameters for the roller gear unit are presented in Table II.

The main transmission, shown schematically in Figure 3, is divided into three reduction stages: input bevel mesh, combining spur mesh, and roller gear drive. The aft portion of the gearbox contains a bevel gear takeoff mesh and mounting pads for all accessories.

The gearbox cross-sectional drawing of Figure 4 shows the actual arrangement of the components. Input power is fed to the transmission from two T58-GE-16 engines rated at 1870 hp each. From each engine, power is transmitted to a spiral bevel gear mesh of 3.05 to 1 reduction, located on each side of the gearbox. The spiral bevel pinion of this mesh is mounted on a quadruple set of ball bearings lubricated centrifugally from an oil distribution tube inside the shaft. The centerline of the driven gear of the first-stage spiral bevel mesh is parallel to the main rotor shaft. This arrangement permits power from both engines to be transmitted through a spur gear combining mesh to the outer shaft, which has its centerline common with the main rotor shaft centerline. This second mesh, which has a 1.54 to 1 reduction ratio, provides a 32-inch spread between inputs to accommodate the side-by-side installation of the T58-GE-16 engines. Located between the first and second reduction stages on each engine drive train is a ramp roller type overrunning clutch. This clutch is designed with outer housing driving and cam overrunning, to assure good lubrication to rollers, cam, and housing during freewheeling.

A spiral bevel gear attached to the lower portion of the outer shaft provides power for the tail and accessories through a speed increasing mesh. Power from the outer shaft is fed by means of a quill shaft to the 19.85 to 1 reduction ratio roller gear unit shown in Figure 5. This is a two-row roller gear drive with ring gear output, fixed carrier, and driving sun gear. The sun gear, Figure 6, splits the power to the first-row pinions into two paths to provide load equilibrium and to eliminate overturning moments about the axes of the pinions. The spline connection on the sun gear is centrally located to assure equal torsional deflection and therefore equal load on the gear teeth between both upper and lower paths. Two rollers, located on the ends of the sun gear, are concentric with the gear pitch diameters and are designed to equal the sun gear pitch diameter at full power when deflected by the induced roller radial loads. The sun gear is constrained in the axial direction by flanges on the ends of the rollers.

TABLE I. S-61 ROLLER GEAR TRANSMISSION DESIGN REQUIREMENTS		
Location	Speed (rpm)	Power (hp max)
Input Drives		
Dual engine	18966	3700
Single engine	18966	1870
Main Rotor		
Roller Gear Output	203	3000
Tail Takeoff Total	7031	700
Tail Rotor Takeoff	3025	565
Accessory Drives		
Generator (Left)	8100	54
Generator (Right)	8100	54
Tachometer	3900	1
Servo Hyd. Pump	4197	6.5
Aux Servo Hyd. Pump	4005	6.5
Utility Hyd. Pump	4005	13
Lubrication Pump	5149	4

TABLE II. ROLLER GEAR DRIVE DESIGN PARAMETERS	
Minimum Sun Gear Diameter	8.00 in.
Maximum Ring Gear Diameter	31.00 in.
Output rpm	203
Input rpm	4029
Reduction Ratio	19.84888:1
Gear Allowable Compressive Stress*	130,000 psi
Gear Allowable Bending Stress (one way)*	55,000 psi
Minimum Bearing Life	3,000 hr
Roller Allowable Compressive Stress	150,000 psi

* Using AGMA calculation method.

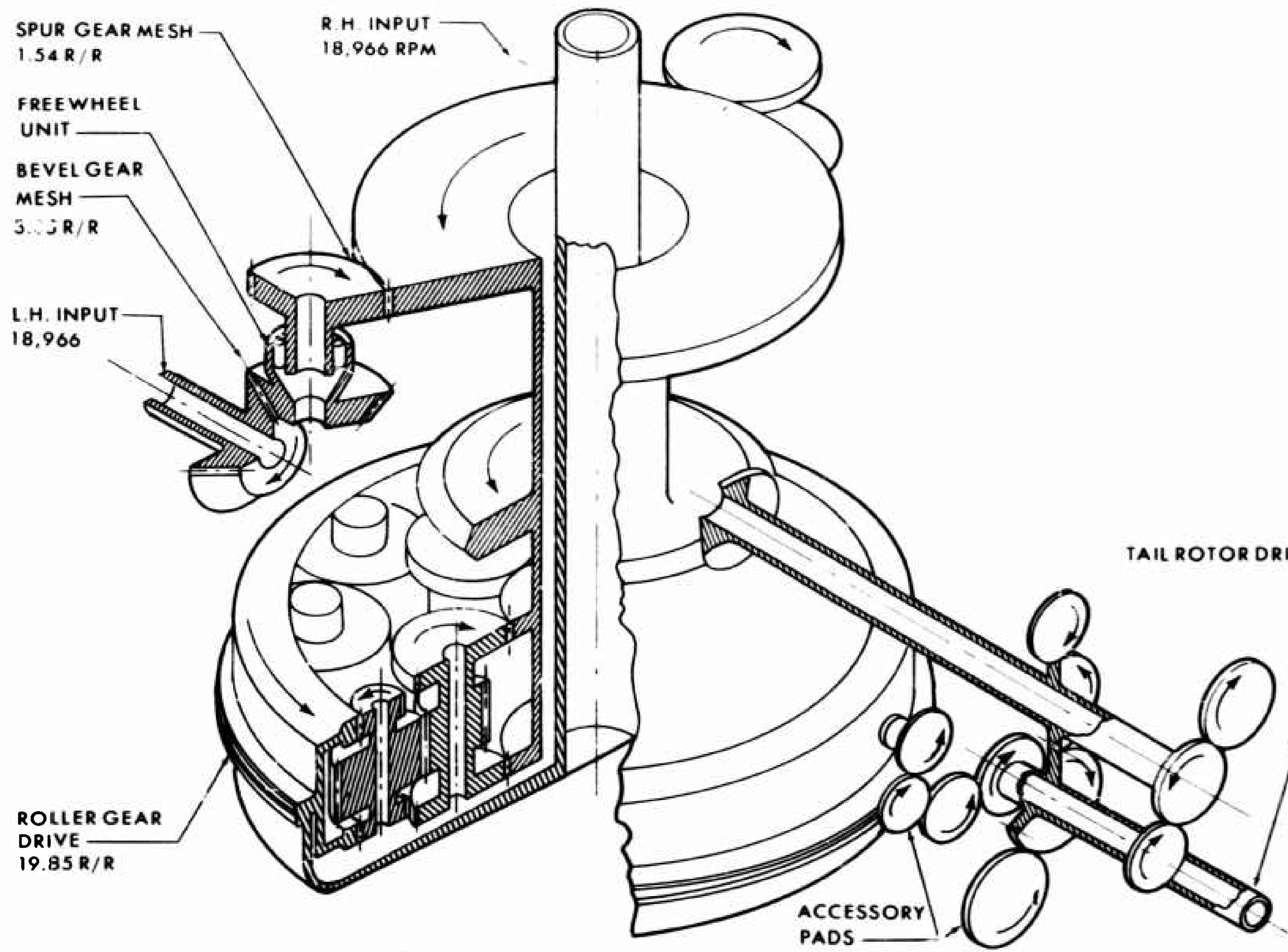


Figure 3. Roller Gear Transmission - Schematic.

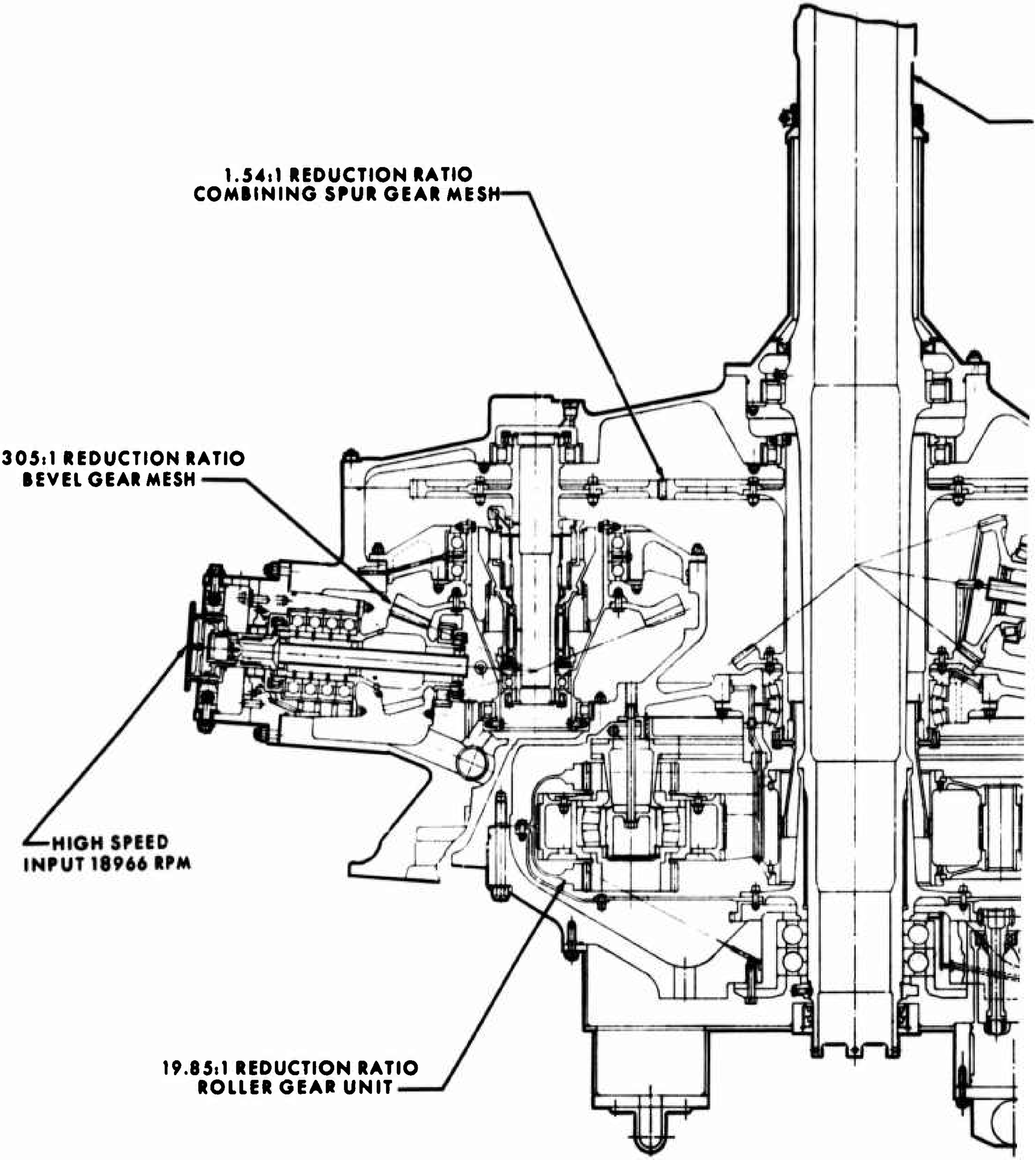
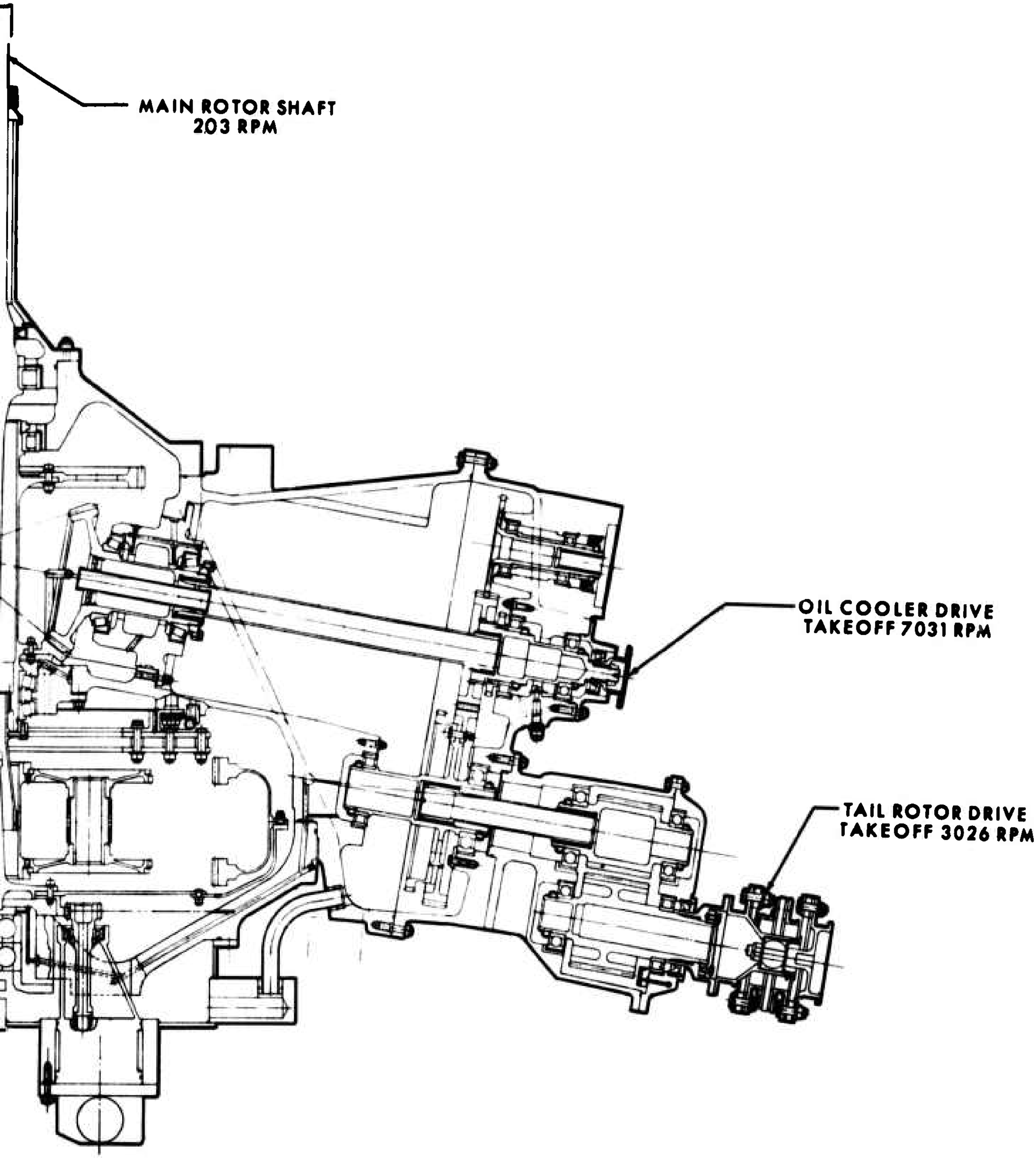


Figure 4. Roller Gear Transmission - Assembly.


MAIN ROTOR SHAFT
203 RPM
OIL COOLER DRIVE
TAKEOFF 7031 RPM
TAIL ROTOR DRIVE
TAKEOFF 3026 RPM

B

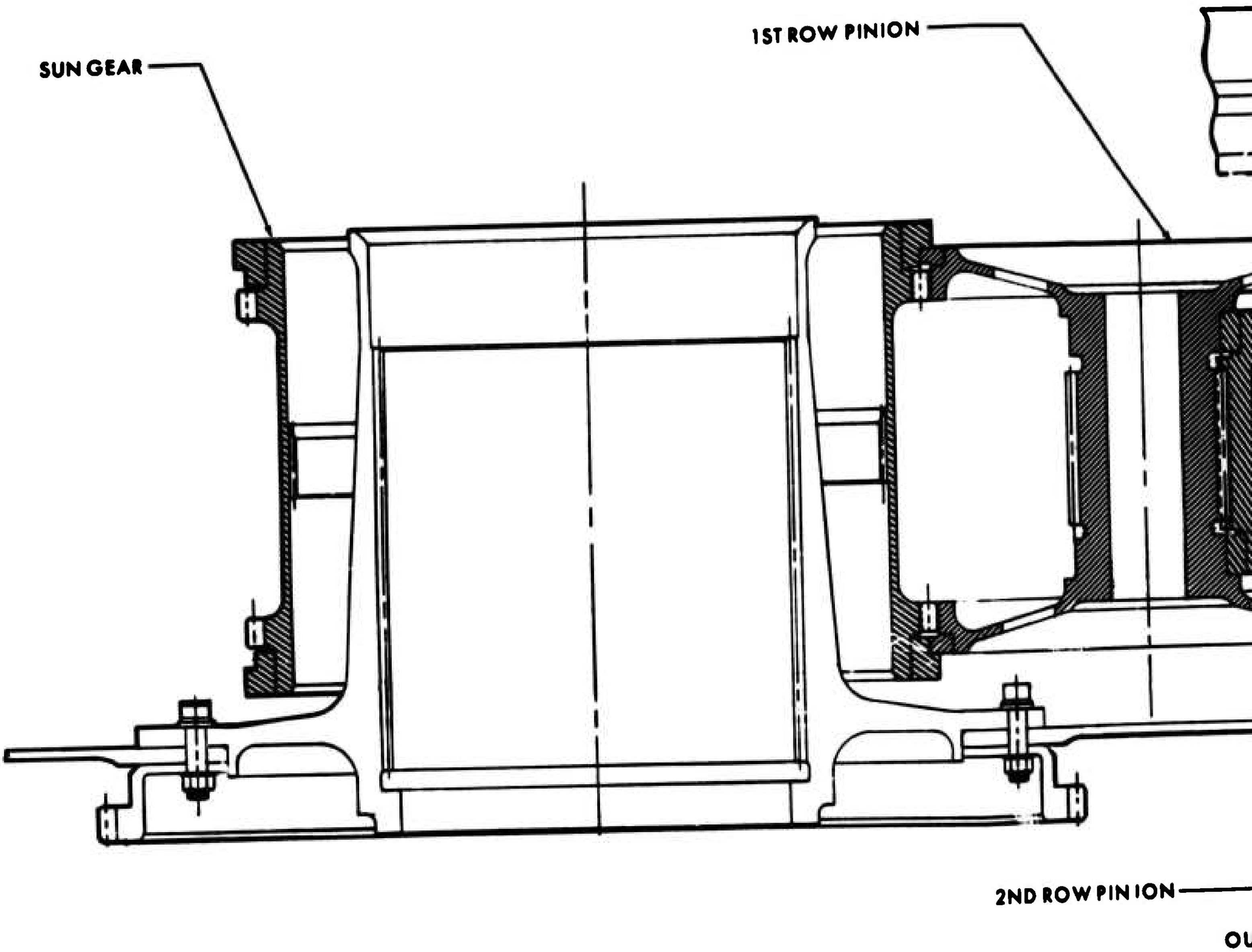
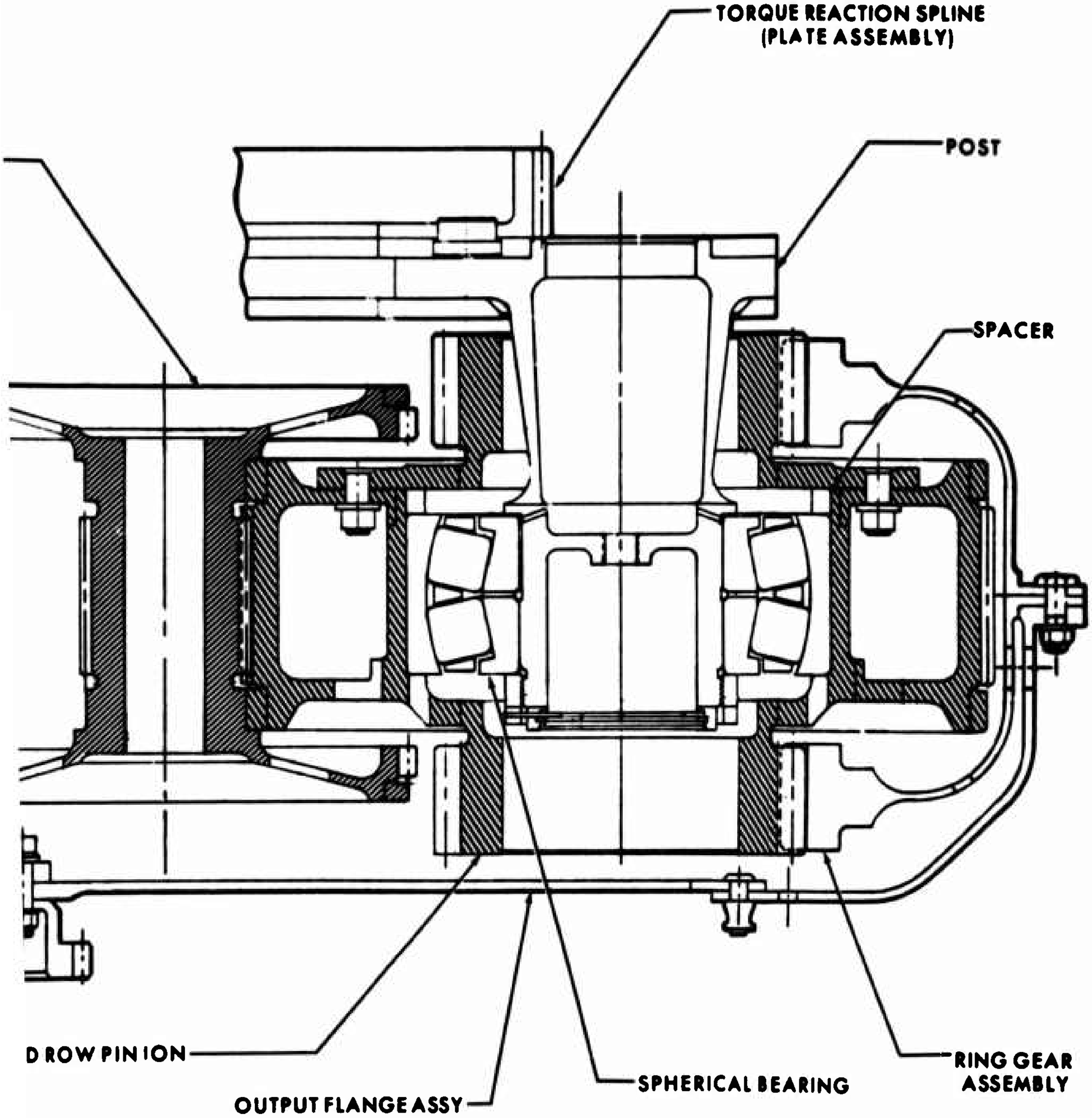


Figure 5. Roller Gear Drive.



TORQUE REACTION SPLINE
(PLATE ASSEMBLY)
POST
SPACER
D ROW PIN ION
OUTPUT FLANGE ASSY
SPHERICAL BEARING
RING GEAR
ASSEMBLY

b

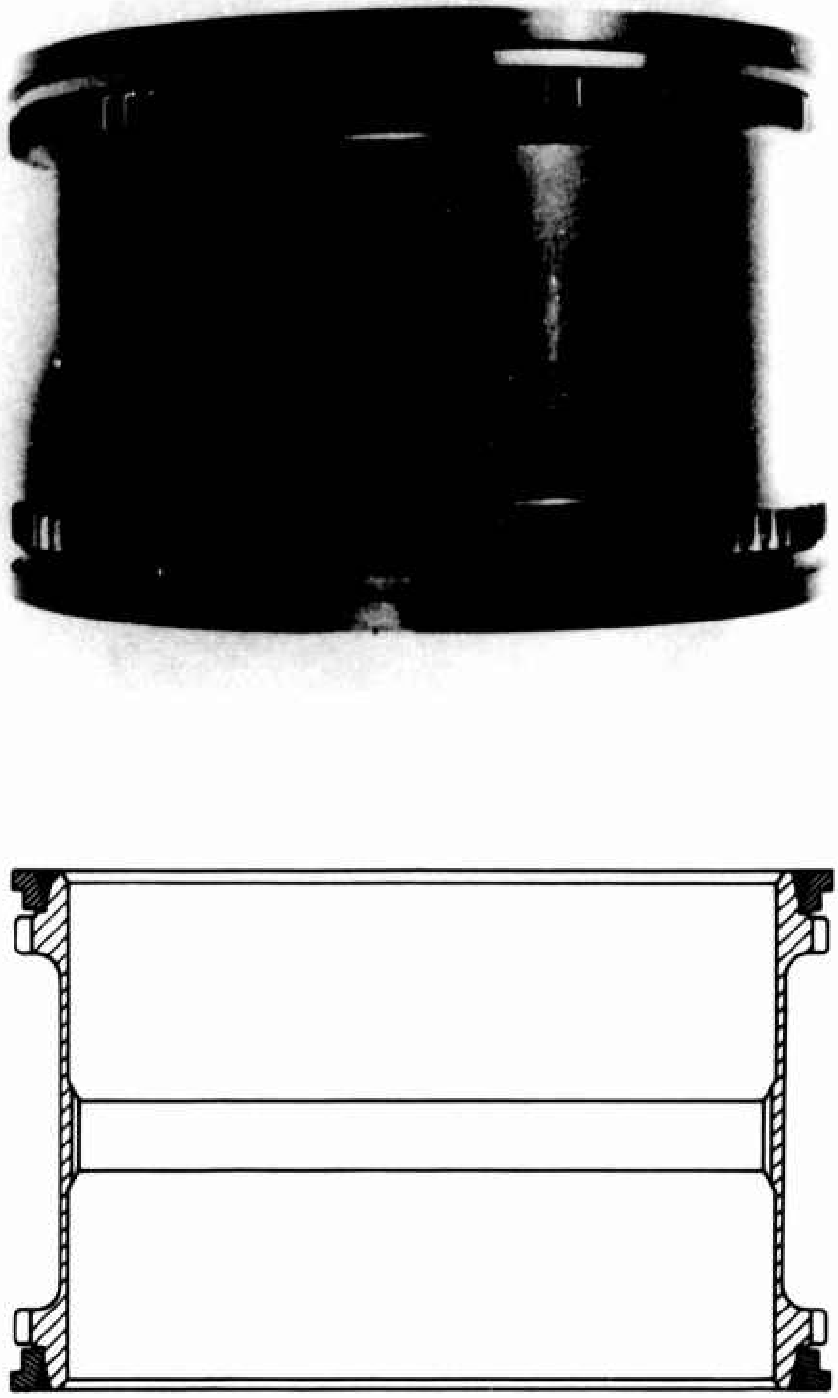


Figure 6. Sun Gear.

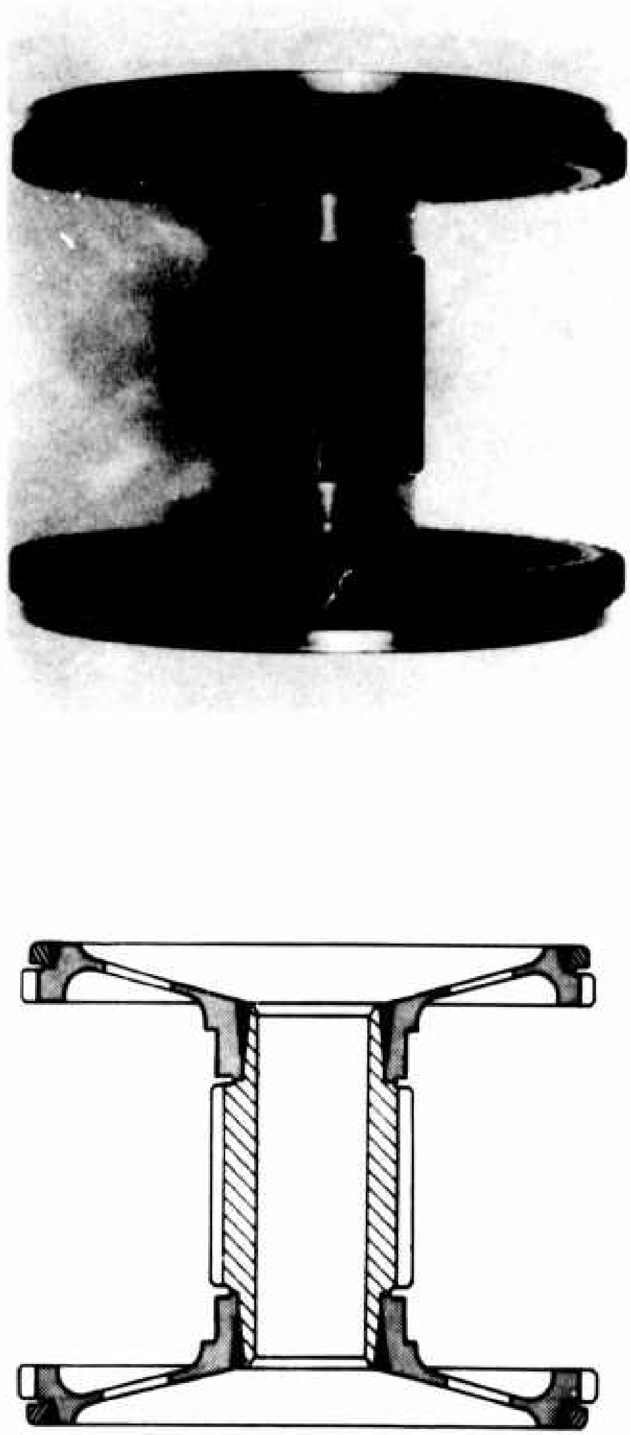


Figure 7. First-Row Pinion.

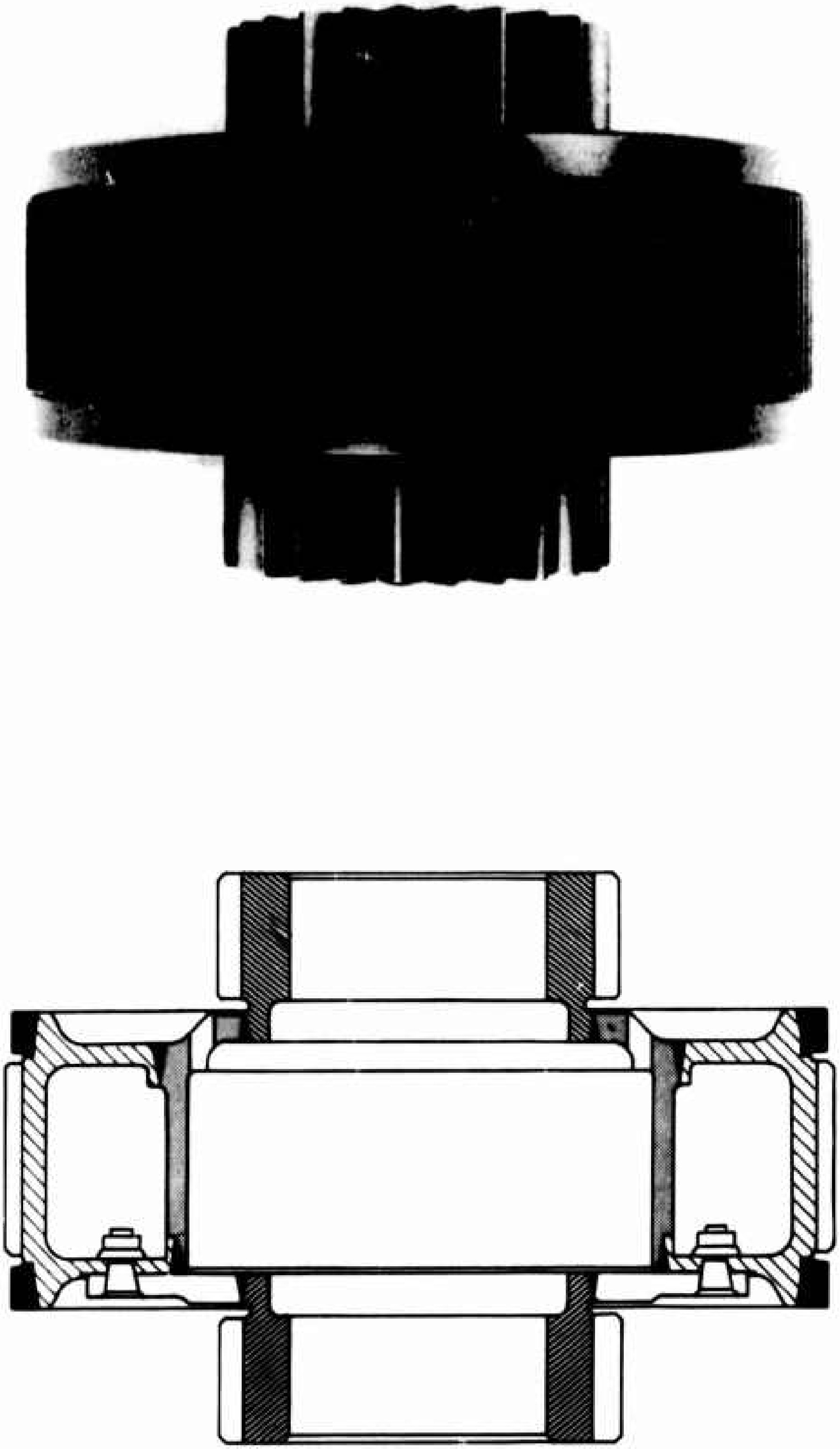


Figure 8. Second-Row Pinion.

The first-row pinion, Figure 7, contains two outer spur gears and rollers which mate with the sun gear, and an inner spur gear which mates with the two adjacent second-row pinions. The first-row pinion is accurately positioned at one point on the inside by the sun gear and at two points on the outside by the second-row pinions. This three-point support is inherently stable and obviates the need for bearing support. The inner rollers of the first-row pinions contain end flanges which constrain these pinions in the axial direction.

The second-row pinions, Figure 8, are supported at two inner points by the first-row pinions, and at one outer point by the ring gear. Spherical bearings are used to hold these pinions in place to react the torque. The internal clearances of the carrier plate reaction bearings are such that under the worst case of roller tolerances plus deflections, the bearings cannot react loads in the radial direction. These bearings react only loads in the tangential direction resulting from the reaction torque of the roller gear unit. The split ring gear, Figure 9, has no rollers since the resultant load on the second-row pinion is radially inward.

Figure 10 shows the arrangement of sun gear, first-row pinions, and second-row pinions, and Figure 11 shows the assembled roller gear unit. The basic data for the roller gear unit is presented in Table III.

TABLE III. ROLLER GEAR BASIC DATA

Location	Diametral Pitch	No. of Teeth	Pitch Diameter (in.)	Pressure Angle (deg)
Sun - a	9.448	84	8.89077	22.5
1st Row - X_1	9.448	58	6.13887	22.5
1st Row - Y_1	13.217	27	2.04282	25.0
2nd Row - X_2	13.217	126	9.53318	25.0
2nd Row - Y_2	5.583	25	4.47788	30.0
Ring - C	5.583	154	27.58374	30.0

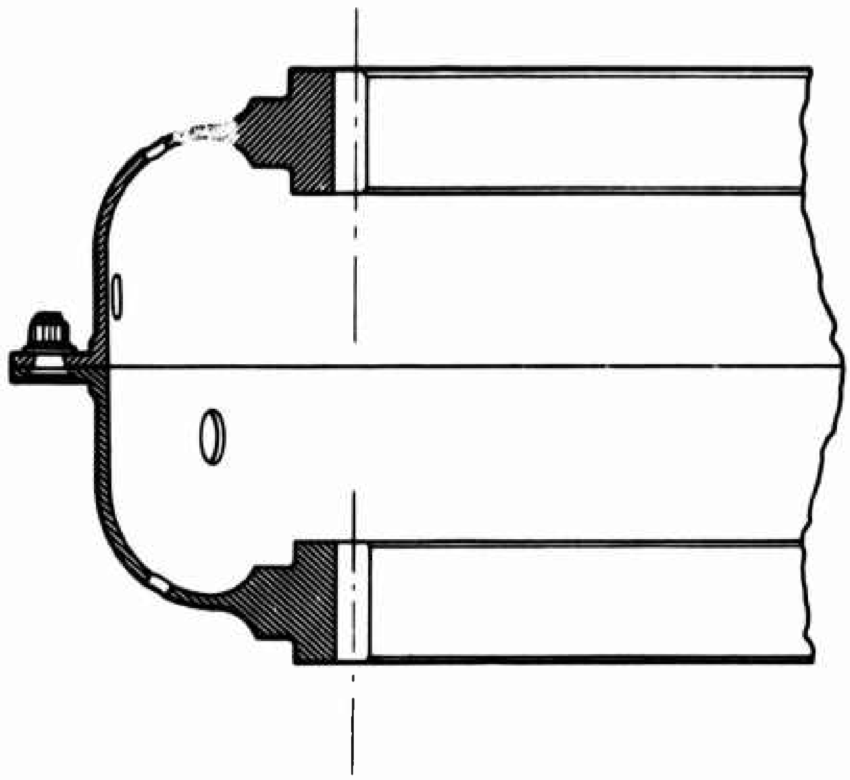


Figure 9. Ring Gear.

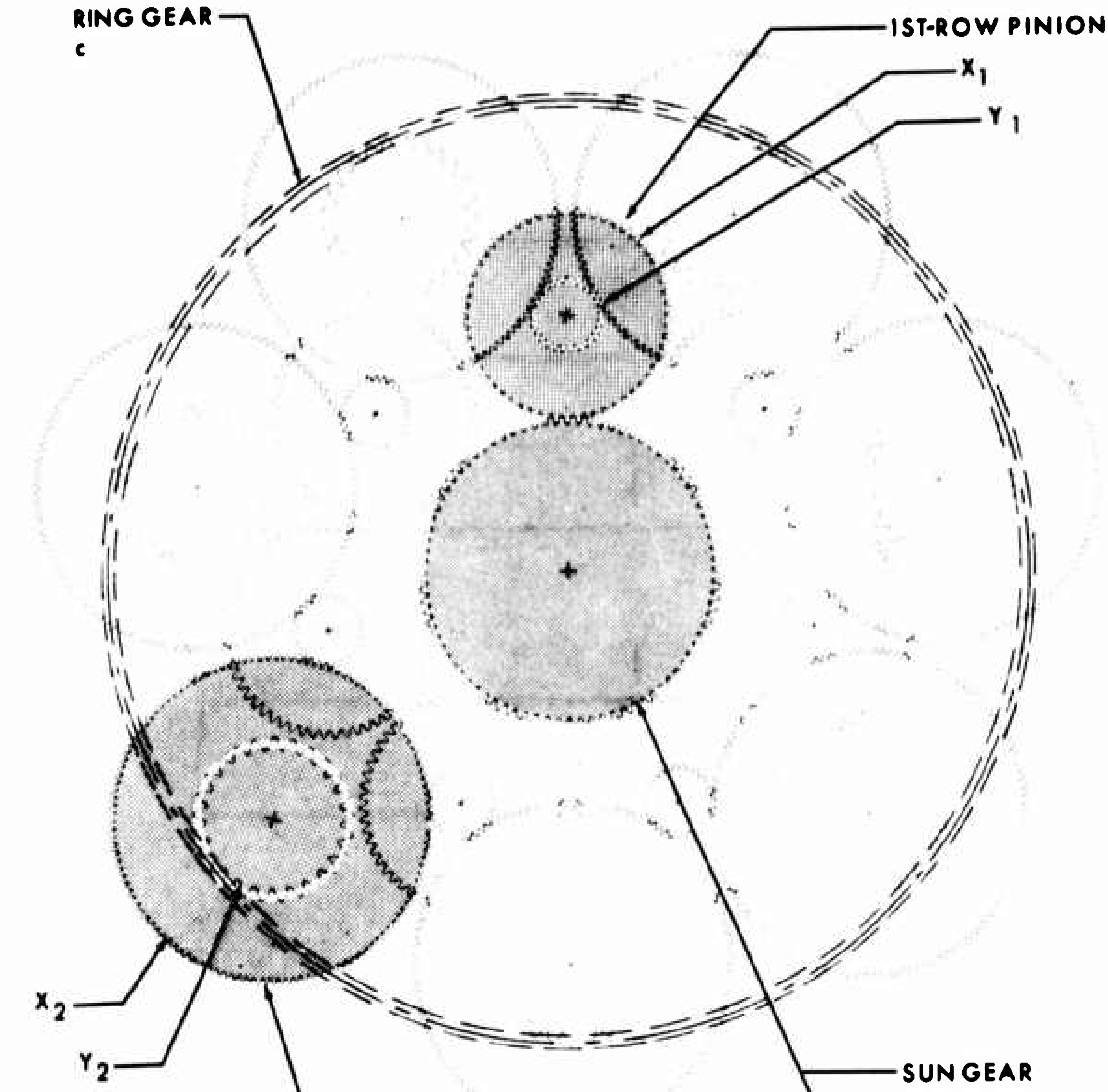


Figure 10. Roller Gear Component Arrangement.

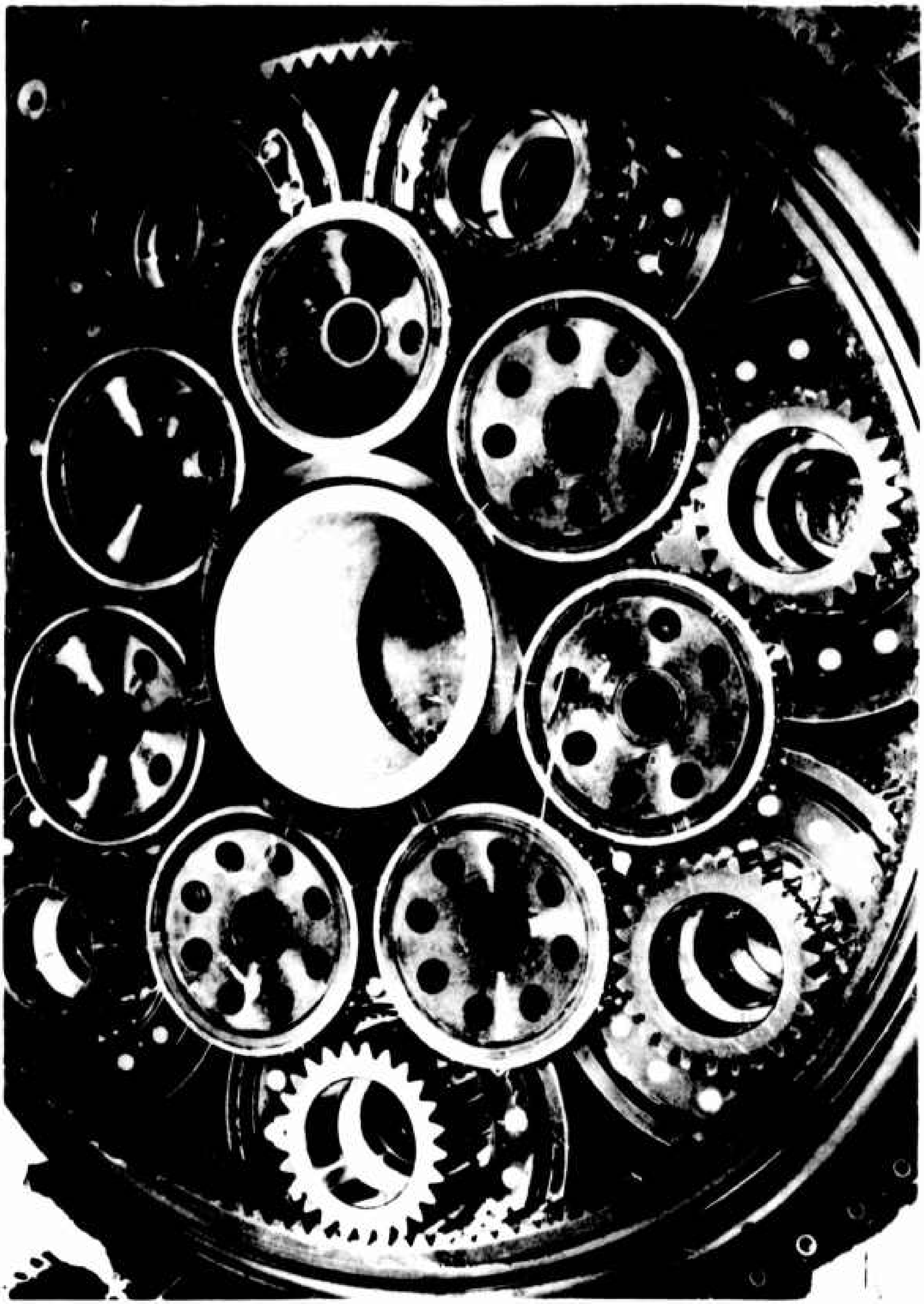


Figure 11. Roller Gear Unit - Assembly.

To ensure contact and proper location of "free" pinions such as the first-row pinions, earlier roller gear units used loading mechanisms that preloaded the first- and second-row pinions, holding them against one another and the sun gear. In these designs, the initial preload had to be sufficient to overcome the resultant gear loads at the maximum power to be transmitted.

The roller loads in the roller gear drive are a function of gear loads and roller gear geometry. Whenever torque is transmitted in the roller gear drive unit, tangential and radial gear tooth loads are induced. The rollers, which transmit loads normal to the rolling surface, must react the resultant loads from the gear teeth. Depending on the geometry and the gear tooth loads induced, the resultant roller loads may be either positive or negative and are directly proportional to horsepower. A negative roller load has no physical interpretation and indicates that the roller gear unit is unstable and tends to roll out of mesh. In this case, external preloading devices are required. However, by careful choice of roller gear design parameters, the roller reactive loads can be made to be always positive, thereby ensuring stability of the three-point support. When the roller gear unit is designed so that all the roller loads are positive, the unit is said to be "self-preloading". This is achieved by using successively higher gear pressure angles for each gear mesh from sun gear to ring gear. The S-61 roller gear unit is a self-preloading unit and has no roller loads when at rest. As soon as power is applied, however, positive roller loads are generated, and all the roller gear members move radially inward to contact each other, thus forming a preloaded assembly. A summary of the preload forces is presented in Figure 12.

The S-61 roller gear drive also features a cantilever mounted cage post with double plate. The double plate effectively expands the cross section to obtain a higher moment of inertia for less weight. The carrier plate attachment to the main housing is accomplished with a splined connection. The male portion of the spline is attached to the carrier plate, while the female member is bolted to the main casting. During operation, the expansion of the magnesium housing with increasing operating temperature has no effect on the carrier plate since the splined connection simply repositions itself. The carrier to housing connection is therefore temperature compensated.

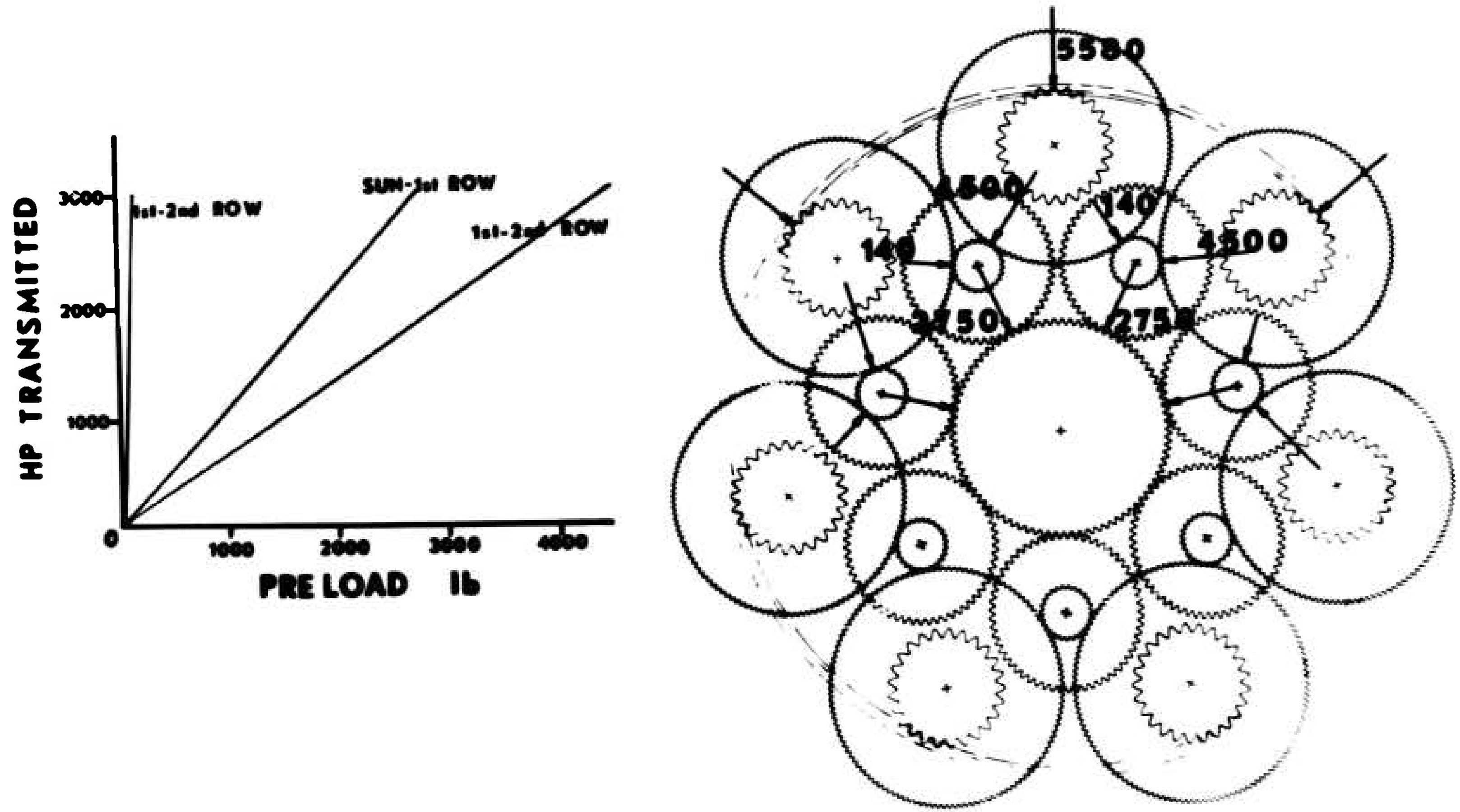


Figure 12. Roller Preload Forces.

The compound planetary arrangement of the roller gear drive pinions requires precise timing of the teeth. Tooth timing is achieved during manufacture and assembly and is best explained by the first-row pinion of Figure 13. In Figure 13, the two large outer gears are timed to each other during manufacture by holding the angular position of the teeth of the gear on one end to within ± 0.0002 inch of the angular position of the teeth on the other end. These outer gears can be imagined as one complete gear with the center portion removed.

The angular positions of the teeth of the inner gear are also precisely positioned during manufacture relative to the angular position of the teeth of the outer gears. A tooth is chosen on the outer gear and is marked as the index tooth. The angular positions of the teeth on the inner gear are then held to the master index tooth on the outer gear as shown by the dimension "X" in Figure 13. This dimension "X" may be any value, but is to be the same within ± 0.0002 inch for all gears in any one assembly.

The teeth of the gears on the second-row pinions are timed in a similar manner to the teeth of the first-row pinions.

The need for holding the timing of these gears all the same becomes obvious when examining the plan view of the roller gear unit, Figure 14. If for example, the teeth of any one of the gears were rotated to another angular position without rotation of the corresponding teeth of the other pinions, it is seen that the mating gear will not mesh properly; i.e., the tooth will no longer line up with a space on the mating gear.

During assembly of the roller gear unit, the master index teeth of all pinions must be aligned in the same angular relationship to their mating gears. If they are not, the ring gear, which is the last gear to be assembled, will not mesh with the teeth of the second-row pinions, since the teeth of one or more pinions will be rotated to an incorrect position. A final assembly check is made by examination of the alignment of the timing marks as shown in Figure 14.

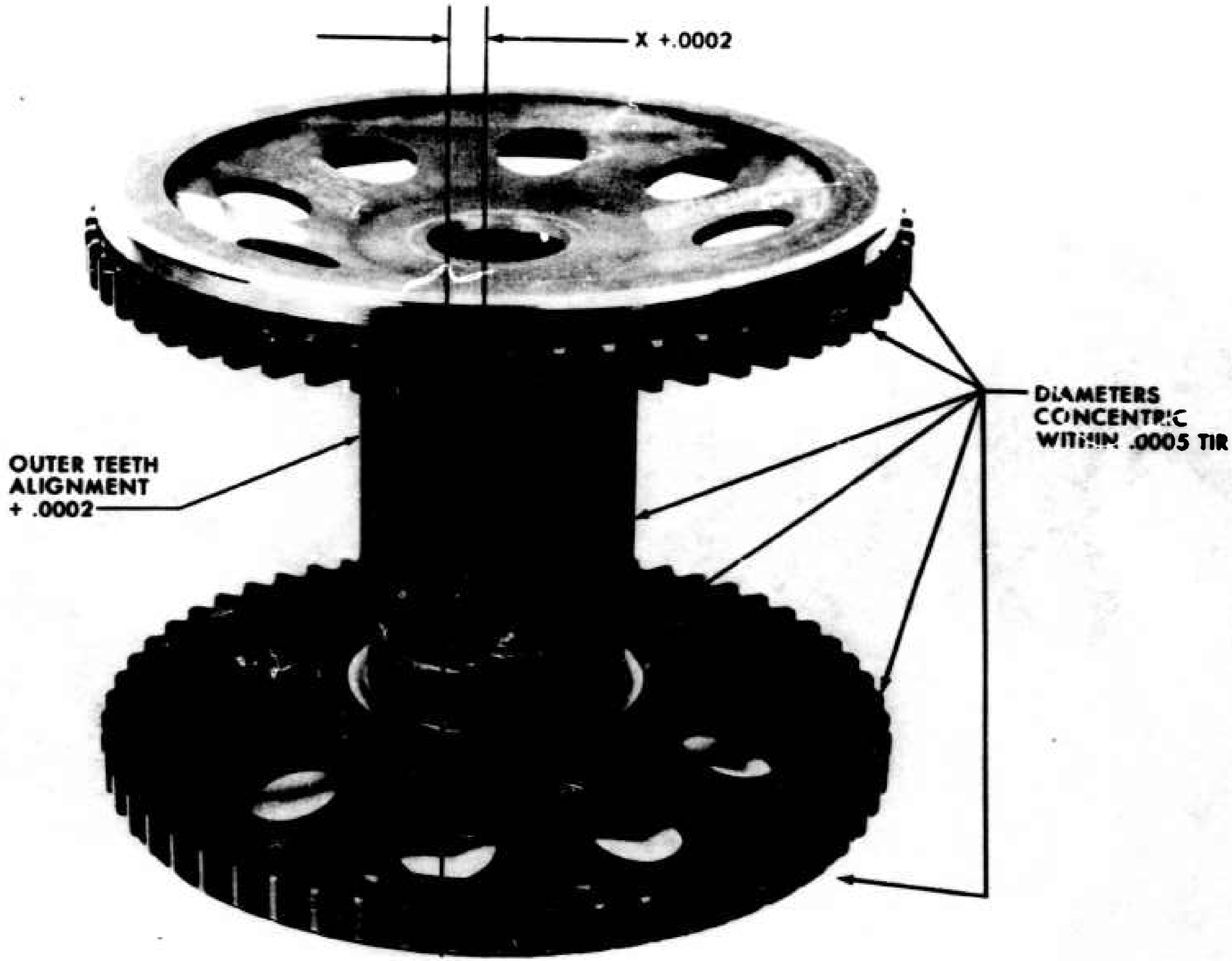


Figure 13. First-Row Pinion - Timing.

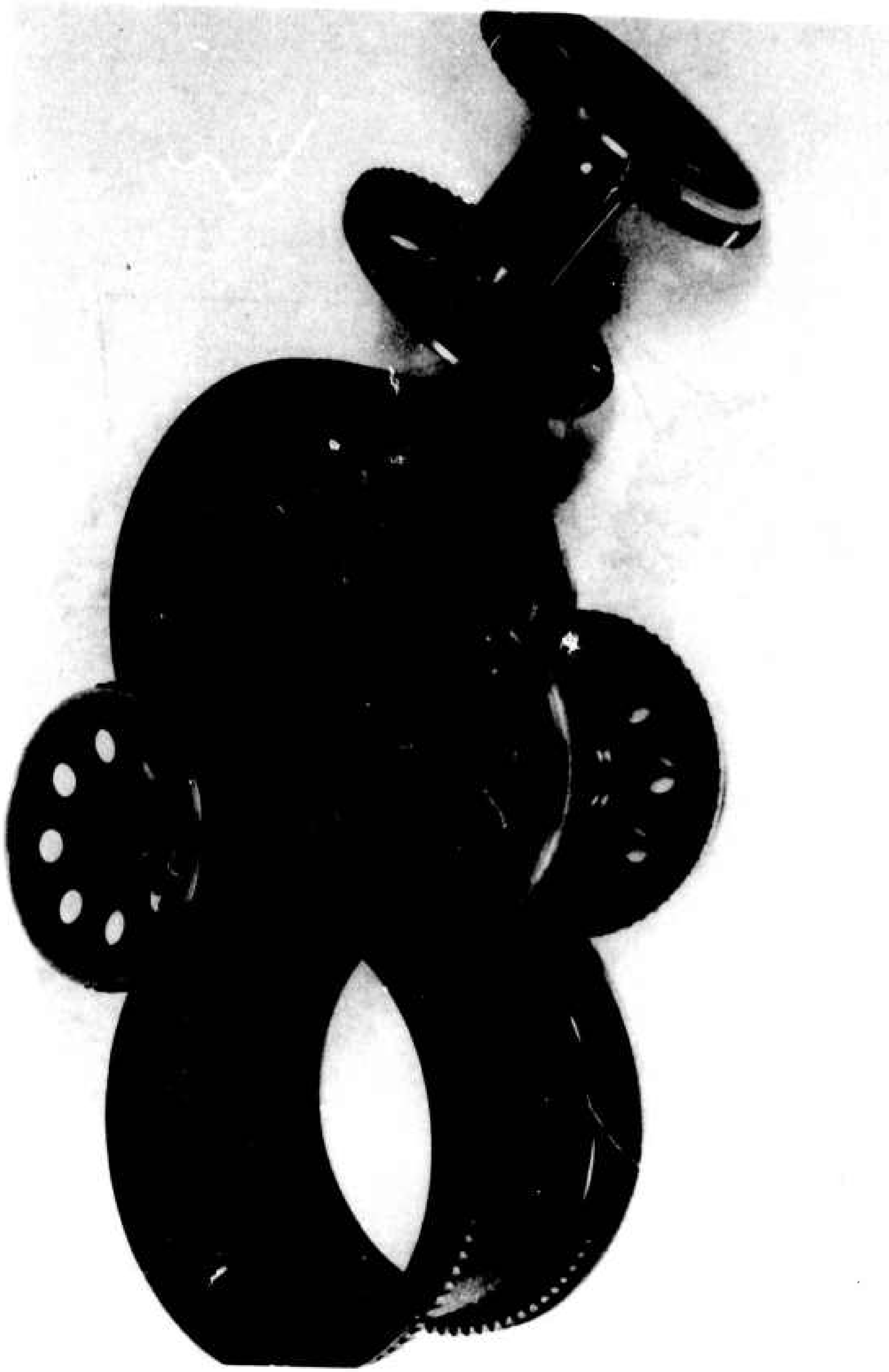


Figure 14. Roller Gear Unit.

TRANSMISSION MANUFACTURE

Four complete roller gear transmission assemblies plus two sets of spare dynamic parts were manufactured.

All primary power gearing of the transmission was manufactured from AMS 6265, a consumable vacuum melt (CVM) case carburizing steel. All other dynamic components were fabricated from AMS 6260 or AMS 6415 steel. Ball and cylindrical roller bearings were made from 52100 CVM steel. The smaller gearbox housings were made from AZ91C magnesium castings. The main housing, however, was machined from a ZE41A magnesium casting. This material, a heat treatable magnesium-zinc-zirconium-cerium alloy, combines good castability and weldability with high strength and pressure tightness at ambient and moderately elevated temperatures. This program marked the first time this alloy was used for a Sikorsky transmssion housing.

The roller gear hardware presented unique manufacturing problems. Because of the complexity of the roller gear drive, where one gear assembly may have as many as three geared surfaces and four roller surfaces, electron beam welding was used extensively in the manufacturing proces. Gear members are joined by electron beam welding as are the rollers to the pinion assemblies. There are 72 electron beam welds in the roller gear transmission: 2 in the sun gear, 4 in each of the 7 first-row pinions, and 6 in each of the 7 second-row pinions. Exploded views of these gears are shown in Figures 15, 16, 17, and 18.

The manufacture of the sun, first-row pinion and second-row pinions required the individual processing of the separate elements through blanking, gear hobbing, case carburizing, and heat treatment. From this point, each gear assembly had a separate and distinct manufacturing cycle.

The gear teeth of the sun gear are finish ground before the end rollers are welded on. The rollers' outside diameters are then ground concentric with the pitch diameter of the gears to within 0.0005 inch T.I.R. (total indicated reading).

The manufacture of the first-row pinion requires the finish machining of the small diameter gear before the machined and case-hardened two outer gears are welded on. These outer gears are then timed to the small gear during their finish grinding operation. The case-hardened outer rollers are then welded on and ground concentric to the outer gear pitch diameter.

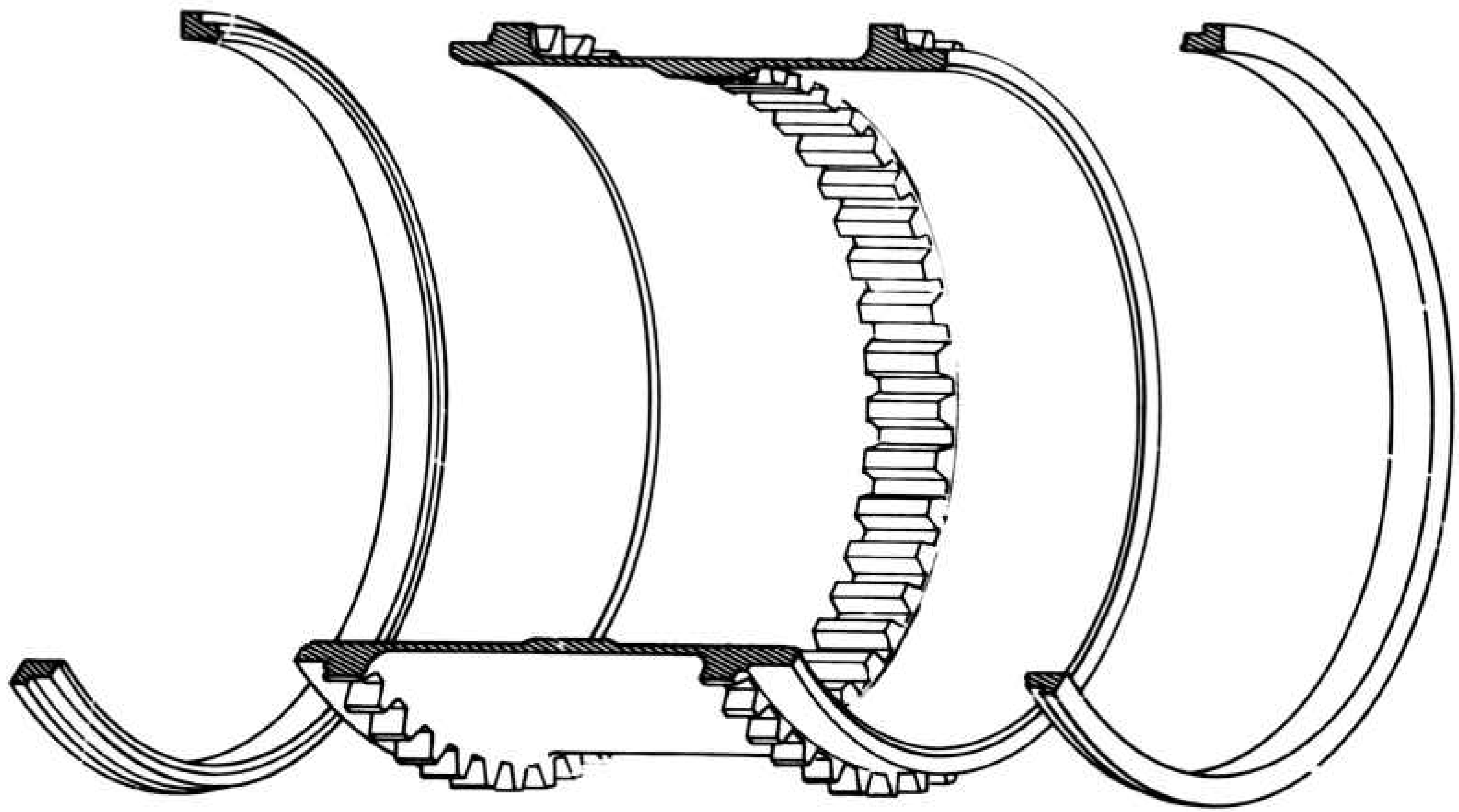


Figure 15. Sun Gear - Exploded View.

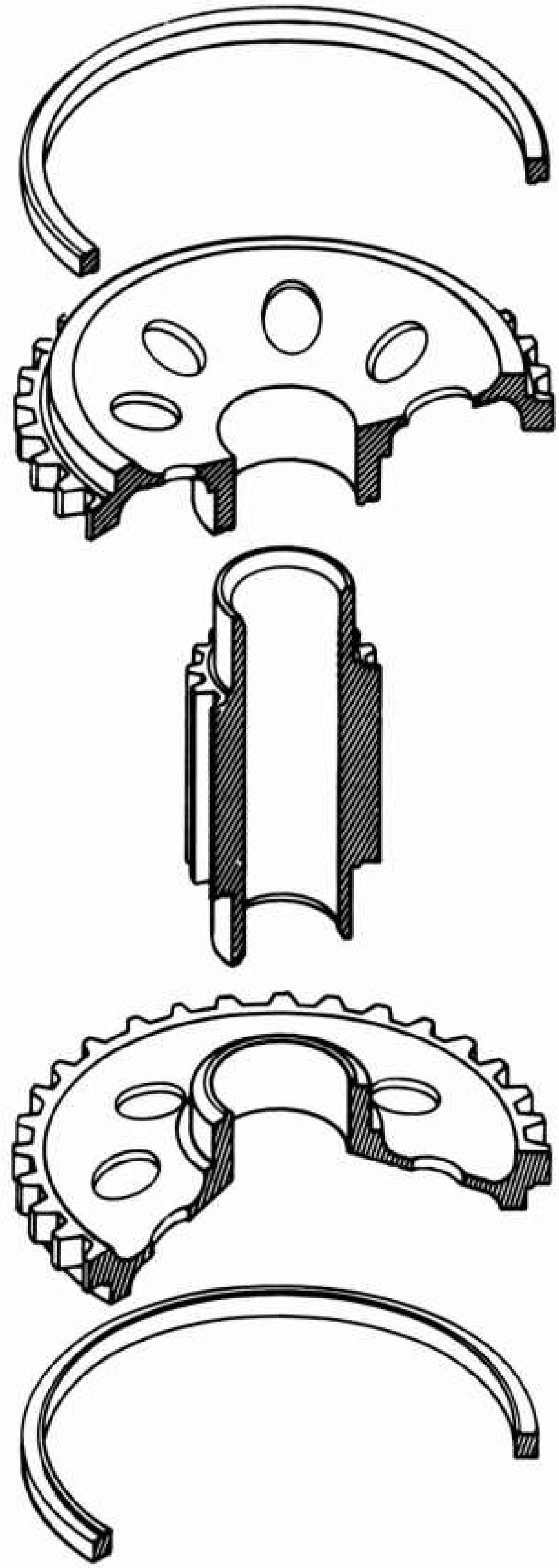


Figure 16. First-Row Pinion - Initial Configuration - Exploded View.

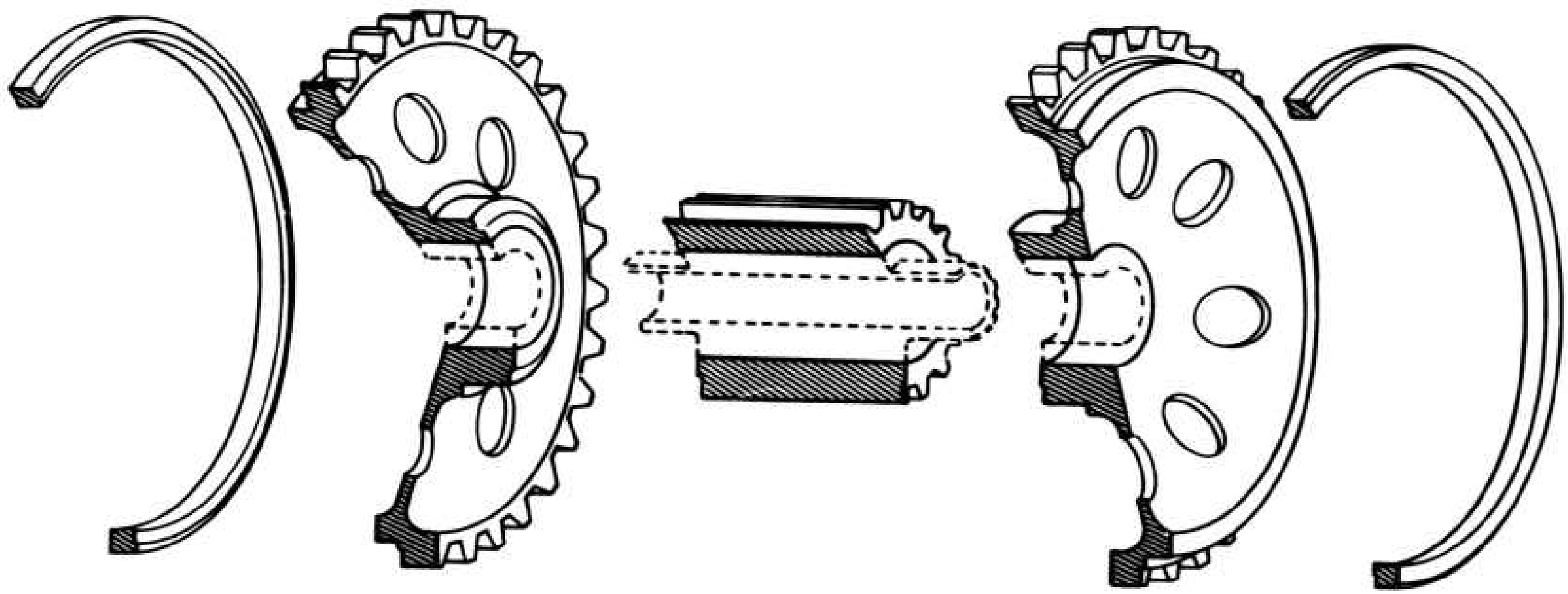


Figure 17. First-Row Pinion - Redesigned - Exploded View.

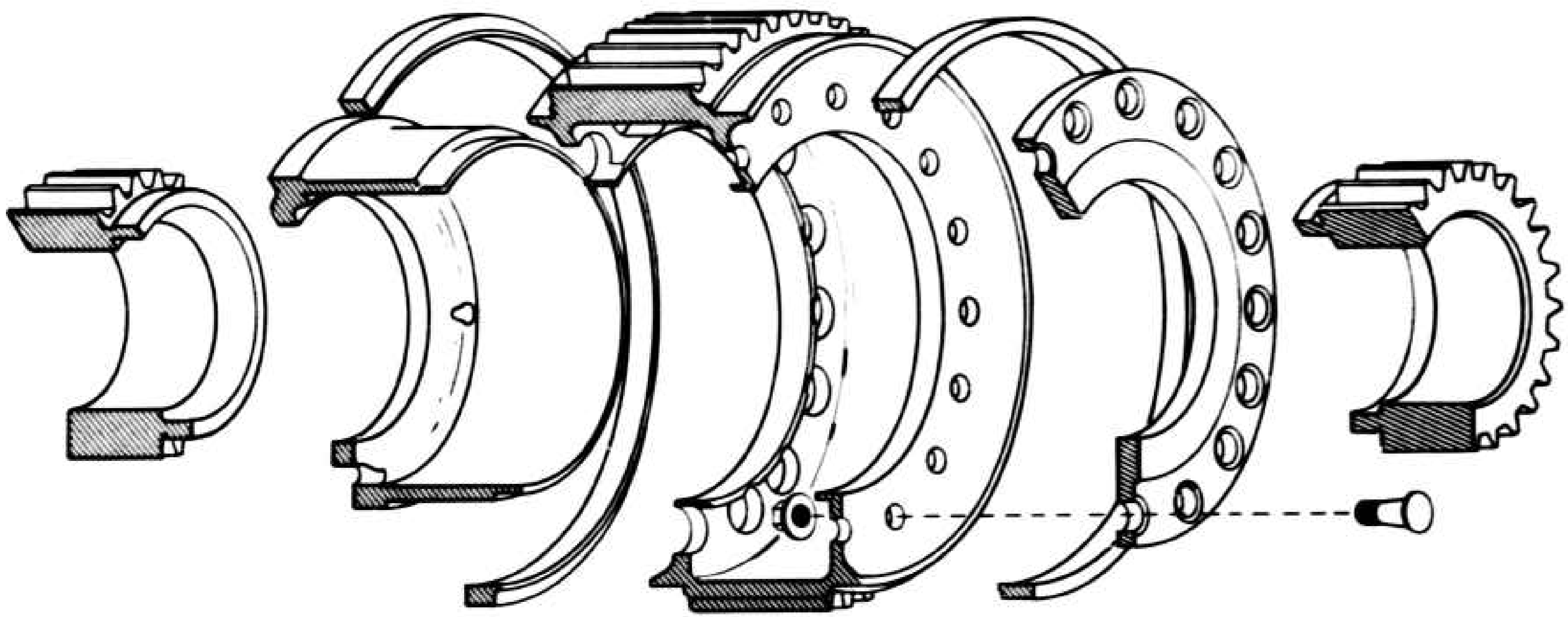


Figure 18. Second-Row Pinion - Exploded View.

Manufacture of the second-row pinion necessitated the assembly and welding of the finished ground and case-hardened small diameter end gears onto the machined and heat-treated center gear assembly. The case-hardened center gear teeth are then finished ground with relation to the end gears, thereby timing the assembly. The carburized and heat-treated rollers are then welded onto the assembly and finished ground concentric to the pitch diameter of the center gear.

The manufacture of the first- and second-row pinions presented several manufacturing problems and extremely close tolerances were demanded. The timing between gear members in these "stepped" roller gear pinions is held extremely close, as is the concentricity of the rollers to one another and to the pitch diameter of each gear. Tooth timing is best explained by the first-row pinion of Figure 13. In Figure 13, the two larger outer gears are timed to the center gear to within ± 0.0002 inch. Also, the two outer gears are aligned to each other within ± 0.0002 inch. A tooth is chosen on the inner gear and is marked as the index tooth. The angular positions of the teeth on the outer gears are then held to the master index tooth on the inner gear as shown by the dimension "X" in Figure 13. This dimension "X" may be any value, but is to be the same within ± 0.0002 inch for all seven gears in any one assembly. When elelctron beam welding the first-row pinion assemblies, the gear members tended to "walk" as much as 0.002 inch relative to the center gear. This "walking" had to be accommodated for in the finish grinding of the outer gears.

The teeth of the gears on the second-row pinions are timed in a similar manner to the teeth of the first-row pinions.

Electron beam weld parameters were developed, prior to the manufacture of the roller gear components by subjecting sample welds to proof tests. Samples of various cross sections were made up and subjected to increasing tensile loads. Load versus strain curves were then plotted from the data of these tests to determine strength characteristics of the welds. Figure 19 shows one of these curves.

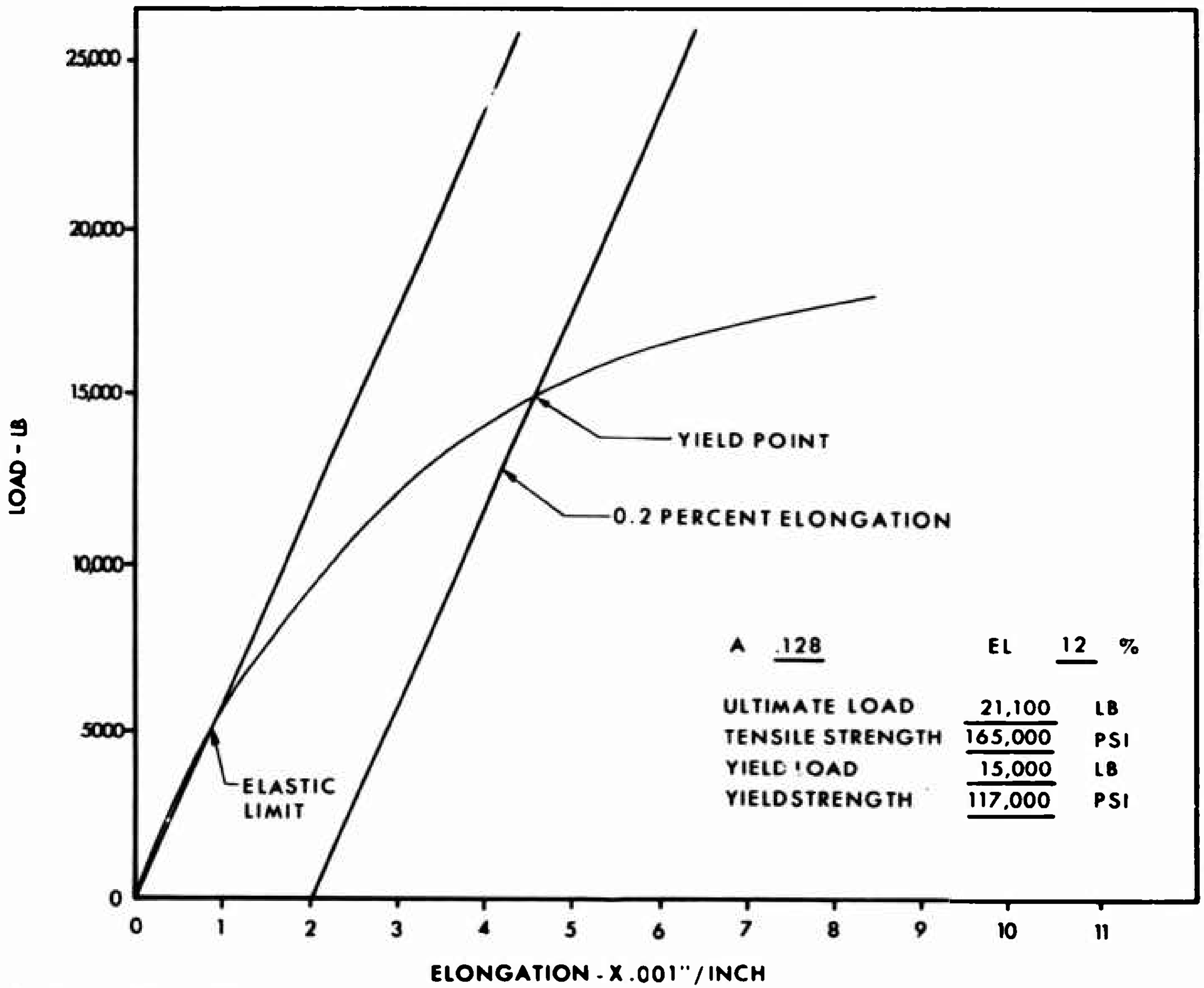


Figure 19. Electron Beam Weld Joint Strength - Load Versus Elongation.

TEST PROCEDURE

The roller gear transmission development program encompassed a series of bench tests, the objectives of which are described in this section. Other than the no-load lubrication test, all testing was conducted in the Sikorsky Aircraft S-61 regenerative bench test facility.

NO-LOAD LUBRICATION TEST

The first test to be performed on the roller gear transmission was the no-load lubrication test. The primary objective of this test was the determination of optimum lubrication parameters for the roller gear transmission. The factors under evaluation were the amount of lubricant and jet sizes required to provide adequate transfer of heat from the dynamic components of the gearbox while minimizing frictional losses caused by oil churning. In addition, the test was intended to locate and eliminate any lubricant flow problems which might be encountered such as restrictive oil paths, improper drainage, etc. Ancillary objectives included checks on the mechanical functioning of the roller drive gearbox, test instrumentation and compatibility of gearbox with S-61 bench test facility.

GEAR PATTERN DEVELOPMENT TEST

The second phase of bench testing to be performed in this program was the gear pattern development test. The primary objective of this test was the evaluation of gear patterns generated when the gearbox was operated under load. Examination of these gear patterns provided verification of the manufacture of the gears and the proper loading and alignment of gears and bearings. This test also provided a check on the functionality of the regenerative test stand with both test and dummy (slave) gearboxes installed. In addition, the gear pattern development test was used to evaluate the performance of special hollow ended roller bearings in the roller gear transmission. These bearings were being tested as a possible alternative to the spherical roller bearings used to support the second-row pinions of the roller gear drive.

INITIAL DEVELOPMENT TEST

Initial development testing was included in the bench tests to provide data for evaluation of the manufacturing methods of the sun gear and first- and second-row pinions of the roller gear drive. These gears were manufactured with the use of electron beam welds in certain operations of fabrication. Electron beam welding is a relatively recently developed method which employs a highly concentrated beam of electrons to melt and thereby fuse components together. Electron beam welding produces a relatively narrow joint (up to 20:1 depth

to width ratio) with a strength comparable to the annealed parent material. Since this program marks the first time electron beam welded gears have been used extensively in a helicopter main transmission, the initial development testing was necessary to check the endurance capabilities of these gears before the start of the 200-hour endurance test. Modifications necessary to ensure failure-free performance of the electron beam welded gears for extended periods of time were made as a result of this phase of testing.

200-HOUR ENDURANCE TEST

The 200-hour endurance test was designed to evaluate the effects on the roller gear transmission of long-term operation in a fatigue environment. The test was divided into two parts. After 110 hours were completed, as per the test schedule of Table IV, the test stand was shut down and both test and dummy gearboxes were removed from the test stand. Strainers and chip detectors were visibly inspected for any signs of failure and the roller gear unit was visually inspected. Upon completion of inspection, both gearboxes were then replaced in the test stand and the test continued for an additional 90 hours as per Table V. Throughout the 200-hour endurance test, transmission temperatures, oil pressures, and oil flows were continuously monitored. In addition, chip detectors were inspected at 10-hour intervals. Following completion of the 90 hours of testing, both gearboxes were removed from the test stand and completely disassembled. All gearbox components were subjected to magnaglow inspection. Those components containing electron beam welds were also subjected to pulse-echo ultrasonic inspection as a check on the integrity of the welds.

EFFICIENCY TEST

Coincident with the 200-hour endurance test, an efficiency test was conducted. The objective of this test was the accurate determination of the efficiency of the roller gear drive transmssion by means of heat loss calculation. In order to accomplish this, the test gearbox was insulated with a thickness of fiberglass insulation on all nonrotating surfaces. The lube oil was plumbed through a water-oil heat exchanger, and both oil lines and heat exchanger were insulated. During the test, input power, tail takeoff power, main shaft power, water-in temperature, water-out temperature, and water mass flow rate were continuously recorded. From the data gathered, the heat loss (a measure of the inefficiency of the system) was calculated from the mass flow rate and the enthalpy of the heat exchanger water. A plot of heat loss expressed in friction horsepower versus input power was constructed by fitting data points by the least squares method.

TABLE IV. ENDURANCE TEST SPECTRUM - 110 HOURS		
Time (hr:min)	Total Input Power (hp)	Tail Power (hp)
15:00	1100	250
50:00	1950	250
25:00	2400	250
10:00	2700	250
6:30	3000	425
1:30	1950	425
1:30	3560	425
:30	3700	425

TABLE V. ENDURANCE TEST SPECTRUM - 90 HOURS		
Time (hr:min)	Total Input Power (hp)	Tail Power (hp)
0:45	400	40
7:30	1100	250
32:00	1950	250
12:30	2400	250
7:00	2700	250
19:30	3000	425
4:30	1950	425
4:30	3560	425
1:45	3700	425

TEST FACILITY

For the testing discussed in this report, a test facility was required in which the roller gear drive gearboxes could be mounted and tested under conditions duplicating as closely as possible actual aircraft conditions. This section discusses in detail the facilities used during the testing described herein. The first section is a short discussion of the no-load lubrication test rig which allowed for the testing of one gearbox to which no external torque is applied. The balance of this chapter discusses the setup of the regenerative test stand which was used for the majority of the testing.

NO-LOAD LUBRICATION TEST RIG

Testing of the roller gear transmission for the no-load lubrication test basically consists of applying a driving force that rotates the gearbox at a variable speed up to 100 percent speed. The driving force is required to rotate the gearbox only against internal friction. Instrumentation to monitor oil temperature, flow, and pressure is incorporated so that accurate determination of optimum lubrication parameters is possible. Although full-load testing may eventually determine additional lubrication requirements, the no-load lubrication test generally establishes the correct lubrication system besides initially checking the dynamic components in the gearbox.

To fulfill the requirement of variable speed in the no-load lubrication test of the roller gearbox, a hydraulic motor was selected to supply the driving force. The tail takeoff flange was selected as the most advantageous location to rotate the gearbox at 100 percent speed due to the speed limitation on hydraulic motors. Driving of the inputs which would have more closely approached aircraft conditions was unacceptable because of the high speed (18,966 rpm) required. The main rotor shaft was unacceptable because of its low speed (203 rpm). Tail takeoff flange rotational speed is 3025 rpm at 100 percent speed and is compatible with most hydraulic drive motors. The estimated no-load 100 percent speed power requirement was 50 hp. A hydraulic motor was selected that would meet these requirements.

The next consideration in the design of the no-load lubrication test rig was the support of the gearbox and drive motor. To expedite testing and reduce cost, the run wagon that is used to support and align the gearbox when installed in the regenerative test stand was selected as the test frame. A removable structural steel framework was added at the rear of the test wagon to support the hydraulic motor drive as shown in Figure 20. This configuration permits the gearbox to be installed directly in the regenerative test stand upon completion of the

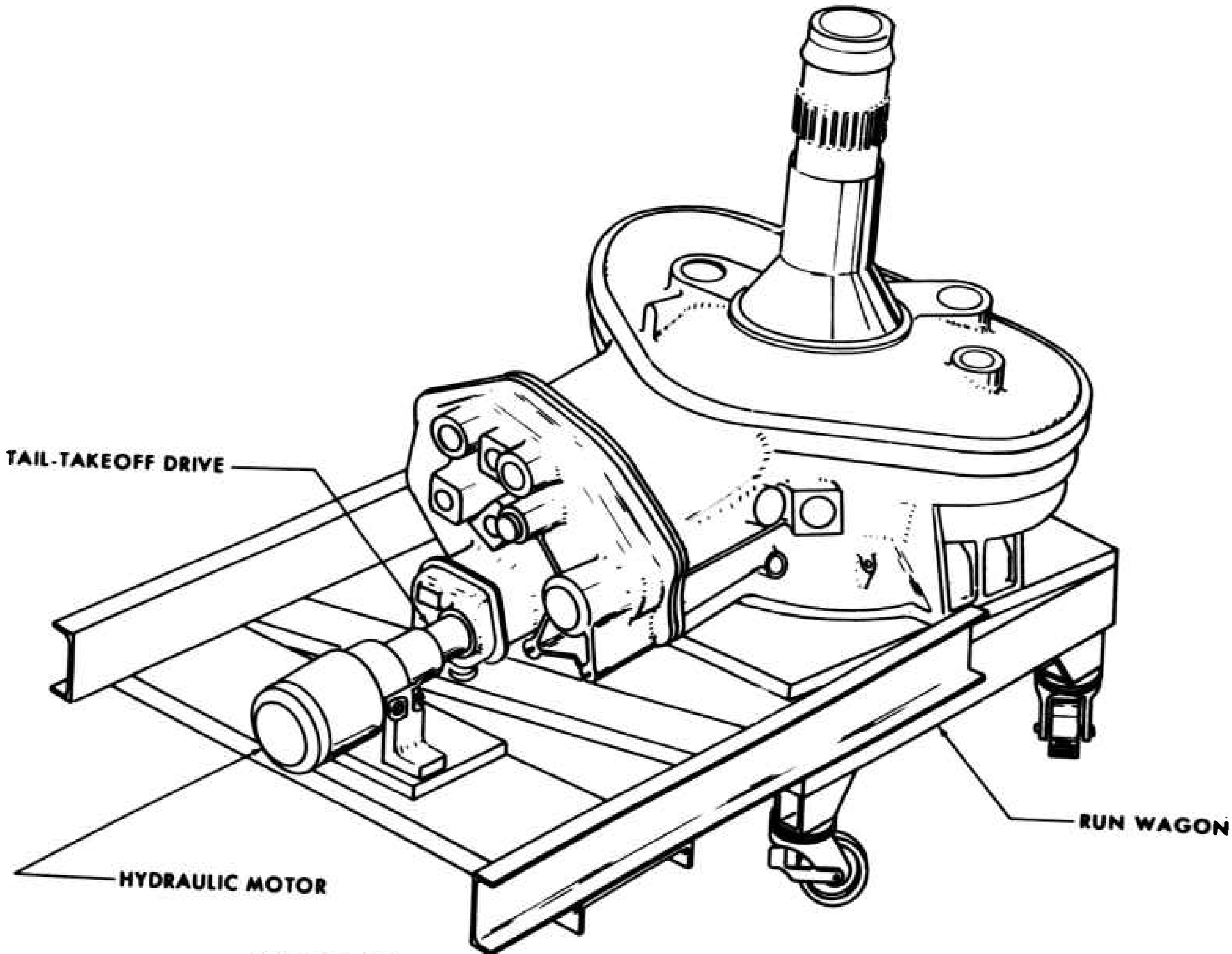


Figure 20. No-Load Lubrication Test Rig.

no-load lubrication test. The only hardware to be removed then would be the hydraulic motor and framework. Most of the basic instrumentation used in the no-load lubrication test is required for the bench test and could remain intact during the transfer from one test facility to the other.

The structural steel framework to support the hydraulic motor was fabricated prior to assembly of the gearbox. Final installation of the framework and alignment of the hydraulic motor was completed after installation of the gearbox on the test wagon. A triple Thomas coupling assembly was installed between the flange of the hydraulic motor and the tail takeoff flange of the aircraft gearbox to allow for small angular shaft misalignments that could occur during the testing.

A 125-hp pumping unit was used to supply power to the hydraulic motor. A thermostatically controlled water-oil heat exchanger permitted operation of the pumping unit for extended periods of time without danger of overheating. An additional water-oil heat exchanger was employed to maintain gearbox lubricating oil temperature at normal operating conditions.

REGENERATIVE TEST STAND

Sikorsky Aircraft employs regenerative type (back-to-back) test stands in the testing of fully assembled transmissions. These facilities permit the testing of transmissions under laboratory controlled conditions. Loads similar to flight aircraft loads are applied to the transmission undergoing tests. Accelerated testing with loads in excess of those obtainable on the flight aircraft may be applied also. Testing is not restricted to environmental conditions and can be conducted on a 24-hour/7-day-a-week schedule.

The basic concept of a regenerative test facility for the testing of transmissions is the incorporation of torque loops. A transmission is essentially a device to transmit torque from point A to point B. Usually associated with this transmission of torque is a change in speed, and a change in angle. The roller gearbox is designed to transmit torque from two General Electric T58-GE-16 engines at 18,966 rpm to the aircraft main rotor head which rotates at 203 rpm and at an angle of 86 degrees to the input. In addition, the roller gearbox supplies torque to a tail takeoff flange which is used to rotate the tail rotor assembly. Additional torque takeoffs are provided to power generators and hydraulic pumps at various speeds.

The S-61 main transmission regenerative test stand at Sikorsky Aircraft, Figure 21, employs two basic torque loops in the testing of aircraft transmissions. In the main loop, Figure 22, torque is applied at the main rotor shaft of the dummy gearbox. It is transmitted through the dummy gearbox and into the test gearbox by means of the input shafts. The torque is then transmitted through the test gearbox up through the main rotor shaft of the test gearbox and back to the main rotor shaft of the dummy by means of spur gears. The second torque loop incorporates a pair of commercial gearboxes connected by a long shaft. The commercial gearboxes are connected to the tail takeoff outputs of the test and dummy gearboxes.

Electric motors, which are connected to the main torque loop, but not in series with the main torque loop, are used to overcome system friction and operate the transmissions at 50-percent and 100-percent speed.

It should be noted that although the "test" gearbox is rotated and loaded to simulate flight conditions, the dummy gearbox is not. In the S-61 test stand, the "dummy" gearbox is rotated in a reverse direction with the loads in the correct direction. In addition, the transmitted load in the dummy is from the main rotor shaft to the inputs, and is of a higher magnitude to compensate for losses in power flow. In most areas of the dummy box, particularly in the roller gear unit, the effect of opposite rotation and the small differences in magnitude of load are negligible. In effect then, the dummy gearbox roller gear unit is a second test sample.

To apply torque to the main "torque loop" in the S-61 main transmission test stand for testing of the standard production S-61 type transmissions, the dummy gearbox ring gear is rotated by means of hydraulic cylinders. The ring gear in the S-61 main transmission, being a fixed nonrotating member of the planetary gear train, transmits torque to the main housing of the gearbox through shear bolts. In the dummy gearbox, the shear bolts are eliminated and the ring gear is allowed to float. To react system torque, the ring gear is secured to the test stand by a pair of hydraulic cylinders which are employed not only to react system torque but also to apply system torque by rotating the ring gear in a direction opposite to that of the system torque.

The roller gearbox design incorporates a rotating ring gear that drives the main rotor shaft. The roller posts which react system torque to the gearbox housing are buried within the gearbox and could not be isolated from the rest of the gearbox in an acceptable manner for applying system torque.

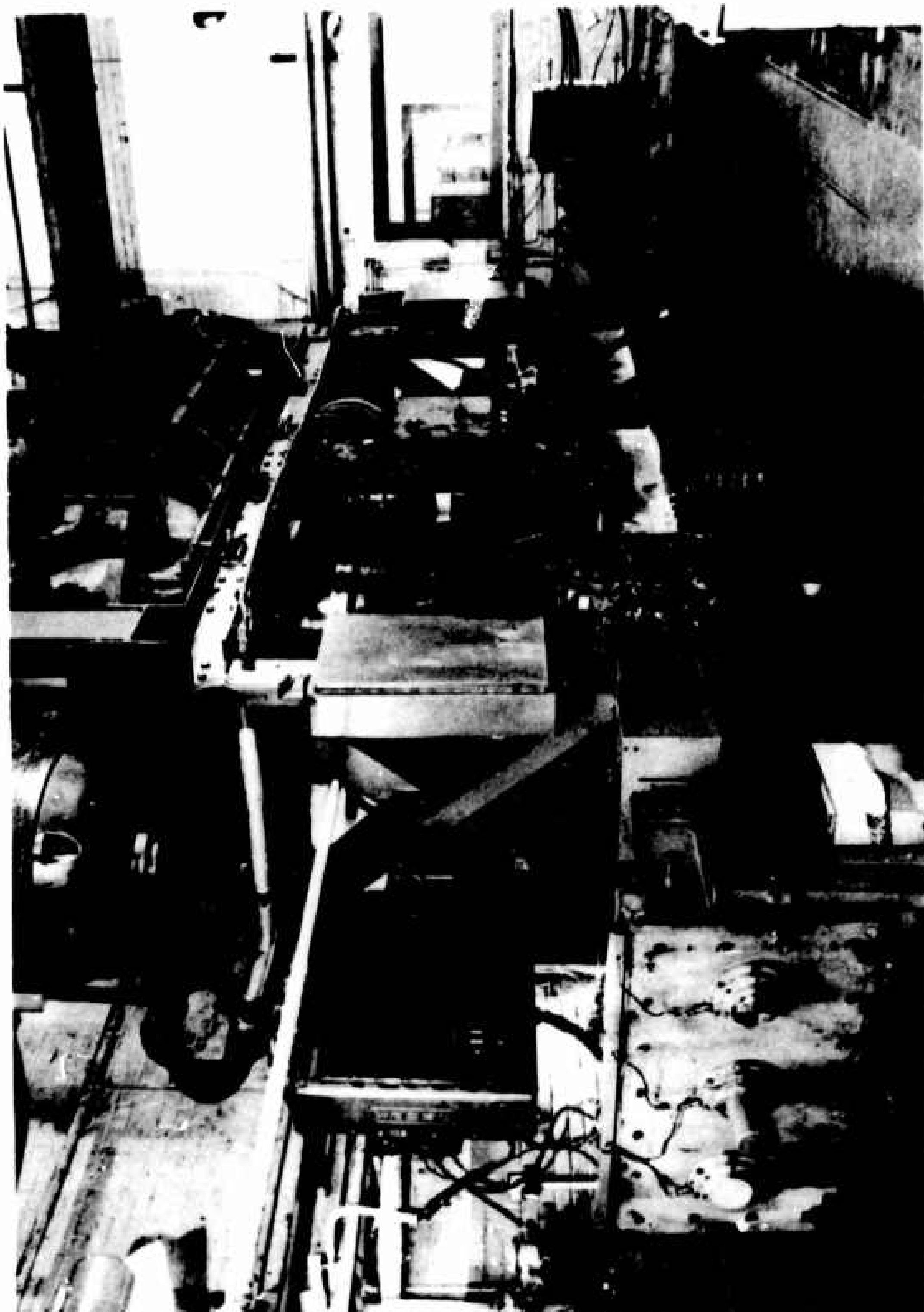


Figure 21. S-61 Regenerative Test Stand.

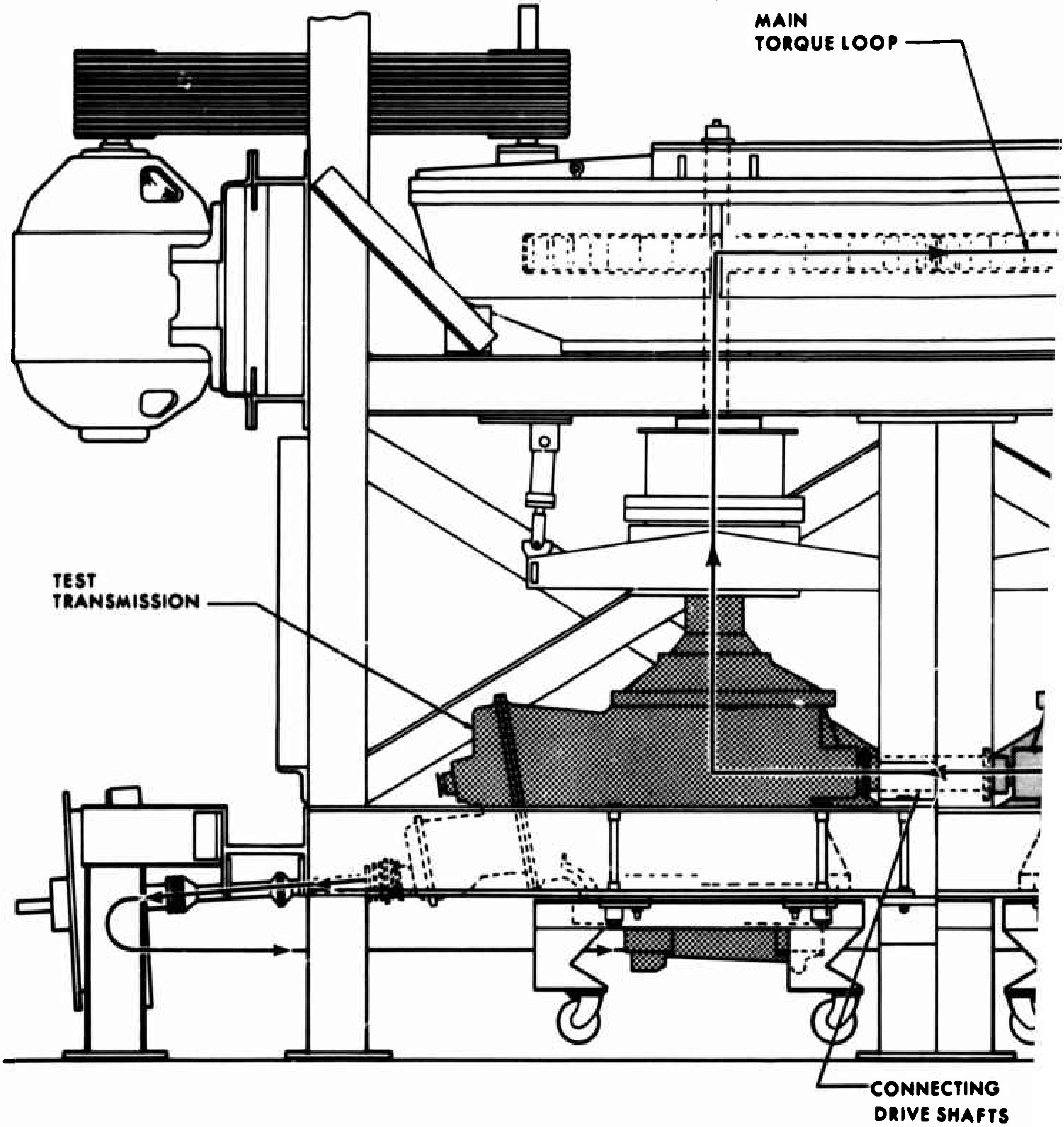
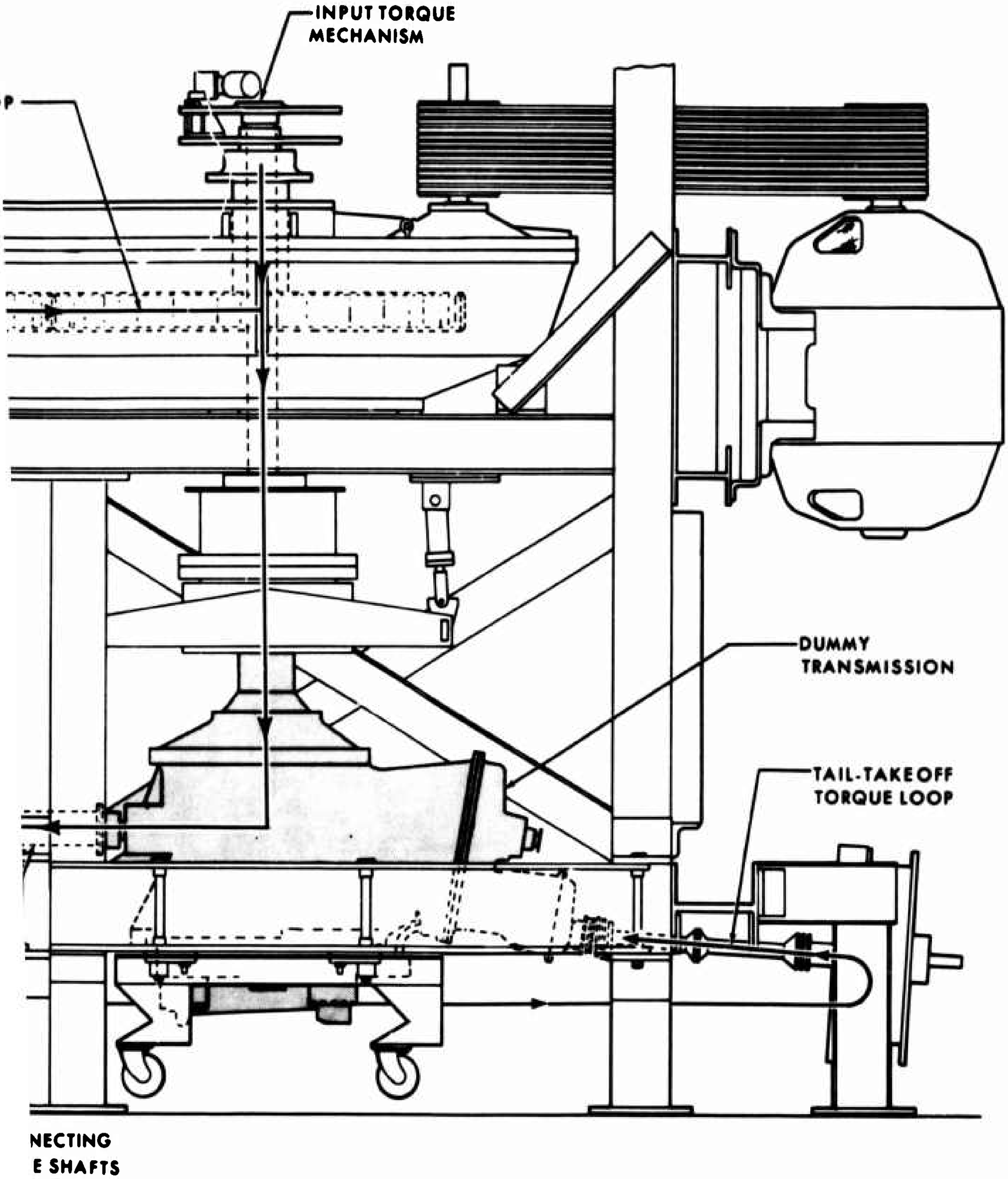


Figure 22. Torque Loops - Regenerative Test Stand.

A


INPUT TORQUE MECHANISM
DUMMY TRANSMISSION
TAIL-TAKEOFF TORQUE LOOP
NECTING
E SHAFTS

B

A modification to the basic S-61 main "torque loop" at the commercial gearbox was designed which would eliminate any rework to the aircraft gearbox for applying torque. The "torque loop" was severed and then reconnected through an arrangement of coaxial shafts and rotating torque plates (Figure 23). Electric jacks are used to connect the torque plate of the inner shaft, attached to the dummy gearbox main rotor shaft, to the torque plate of the outer shaft, attached to the commercial gearbox dummy bull gear. Actuation of these jacks rotates the inner shaft torque plate relative to the outer torque plate and thus applies torque to the system. Power to the torque jacks is through an electrical slip ring mounted on the axis of rotation. Control of the torque jacks is accomplished at the operator's console.

No rework of the secondary or tail drive shaft "torque loop" was required for this test, since the roller gearbox tail drive shaft system is identical to that of the standard S-61.

The overall envelope of the roller gearbox when compared to a production S-61 gearbox is lower and wider. Extensive rework to the structural steel supports of the test facility was required to accommodate the roller gearbox. In addition, the rework had to permit both roller gearboxes and production S-61 gearboxes to be tested in the same facility. Maintaining alignment between test and dummy inputs and between test and dummy outputs with the commercial gearbox incurred installation of additional supports before any of the existing structural steel was modified.

GEARBOX INSTRUMENTATION

Instrumentation requirements for the bench test of the roller gearbox were as follows:

Thermocouples	48
Strain gage measurements	18
Chip detectors	4
Pressures	7
Flow	1
Speed	1

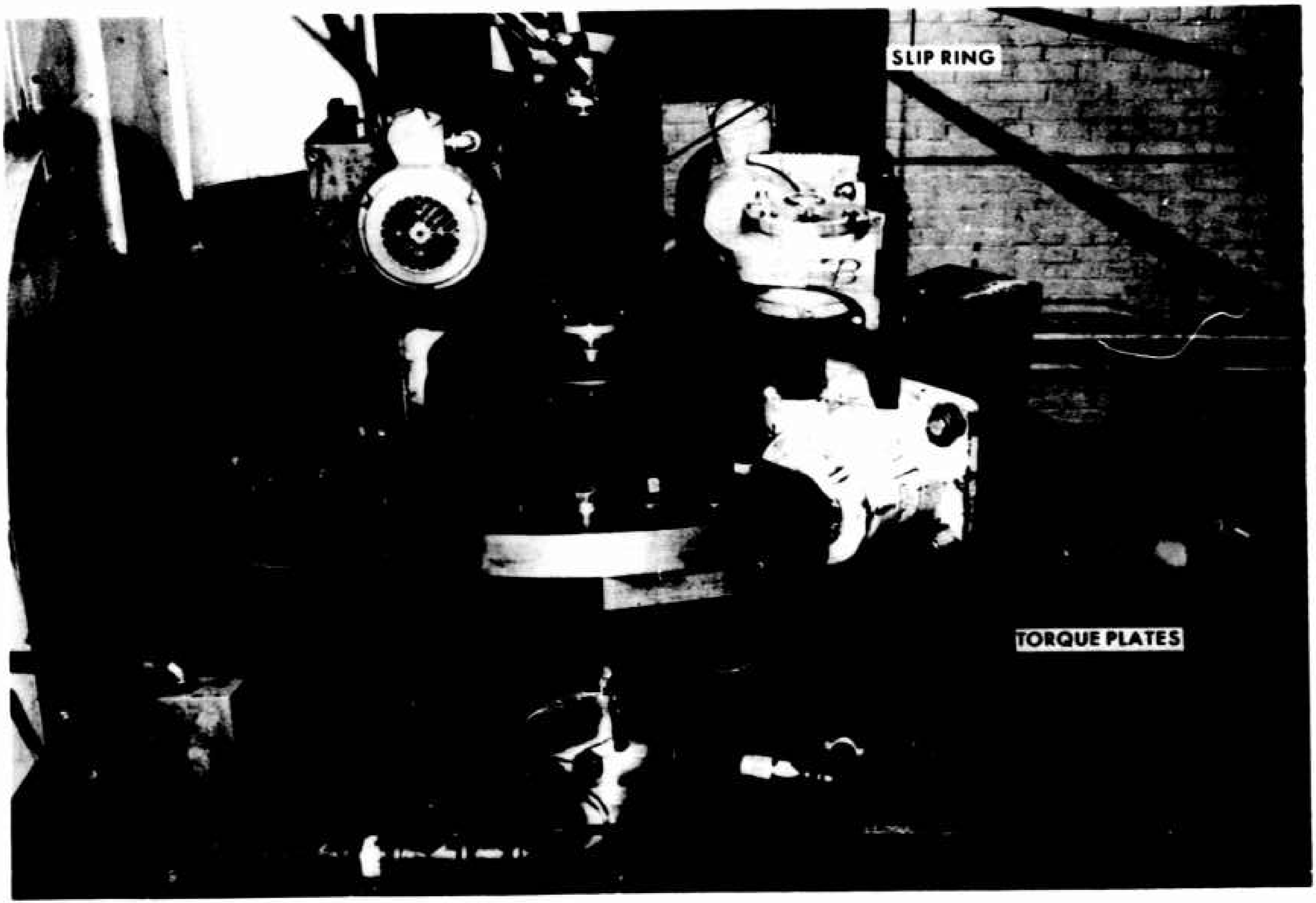


Figure 23. Torque Mechanism - Regenerative Test Stand.

Thermocouples were installed in each gearbox at all primary bearings. The thermocouple locations are tabulated in Table VI and shown in Figure 24. These thermocouples are basically washer types, installed at or near the load zone of the non-rotating member of the bearing. Lead wires from the thermocouples were extended through holes in the outer housing to strip chart recorders. To eliminate oil leakage at these holes, packing gland fittings were installed, which compressed a rubber grommet around the lead wire. The strip chart recorders were of a sequential type that continually printed each temperature at 2.5-second intervals. In addition to measuring bearing temperatures, thermocouples were also installed to measure oil and ambient air temperature.

Strain gages were used to measure torque through both the main and tail drive shafts. All roller posts were also strain gaged using a full wheatstone bridge configuration in both the radial and tangential directions as shown in Figure 25. Outputs of all strain measurements were recorded on light beam oscillographs.

Pressure measurements were made at the two lubrication oil pumps, all manifolds, the two input extentions of the dummy gearbox, the input lines to roller gear units, and the jets furthest along the oil lines from the pump. Each pressure was monitored on direct reading pressure gages at the operator's console.

The oil lubrication systems of both the test and dummy gearboxes are connected to the test facility system. Each gearbox is serviced by separate filters and heat exchangers. The gearbox lubrication pumps supply the pressure for the system as shown in the schematic of Figure 26. A facility auxiliary pump which operates only when pressure from the gearbox pump drops below 40 psi is plumbed into the system.

Oil flow to each gearbox was monitored using a flow turbine installed in the lube oil pump discharge line. Readout of flows was on a frequency convertor installed in the operator's console.

Chip detectors were connected to a panel mounted light/alarm system. Each gearbox was equipped with four separate chip detector/strainer combinations. One chip detector was installed in both the l.h. and r.h. input drains. Others were located in the rear section drain and in the main lube oil sump, as shown in Figure 27.

TABLE VI. THERMOCOUPLE LOCATIONS, ROLLER GEAR TRANSMISSION	
Number	Location
1	L.H. dummy gearbox extension ball bearing
2	R.H. dummy gearbox extension ball bearing
3	L.H. input bevel pinion stack ball bearings
4	R.H. input bevel pinion stack ball bearings
5	L.H. input bevel pinion roller bearing
6	R.H. input bevel pinion roller bearing
7	L.H. input bevel gear lower roller bearing
8	R.H. input bevel gear lower roller bearing
9	L.H. input bevel gear duplex bearings
10	R.H. input bevel gear duplex bearings
11	L.H. input spur gear upper roller bearing
12	R.H. input spur gear upper roller bearing
13	Main rotor shaft roller bearing
14	Outer shaft roller bearing
15	Outer shaft tapered roller bearings
16	Bevel pinion T.T.O. forward tapered roller brg.
17	Bevel pinion T.T.O. aft tapered roller bearing
18	Spur gear T.T.O. roller bearing
19	Main rotor shaft duplex ball bearings
20	Second-row pinion spherical bearing
21	Second-row pinion spherical bearing
22	Second-row pinion spherical bearing
23	Second-row pinion spherical bearing
24	Second-row pinion spherical bearing
25	Second-row pinion spherical bearing
26	Second-row pinion spherical bearing
27	Spur gear T.T.O. ball bearing
28	Adaptor gearbox input forward ball bearing
29	Adaptor gearbox output ball bearing
30	Adaptor gearbox idler ball bearing
31	Adaptor gearbox output roller bearing
32	Adaptor gearbox idler roller gearing
33	Adaptor gearbox input aft ball bearing
34	Spur gear input T.T.O. roller bearing
35	Spur gear output T.T.O. ball bearing
36	Rotor brake forward ball bearing
37	Rotor brake aft ball bearing
38	Lubrication 'oil out' temperature
39	Lubrication pump roller bearing
40	R.H. generator ball bearing
41	Lubrication 'oil in' temperature
42	L.H. generator ball bearing
43	L.H. generator roller bearing
44	Utility pump roller bearing
45	Auxiliary pump roller bearing
46	Primary pump ball bearing
47	Tachometer ball bearings
48	Ambient air temperature

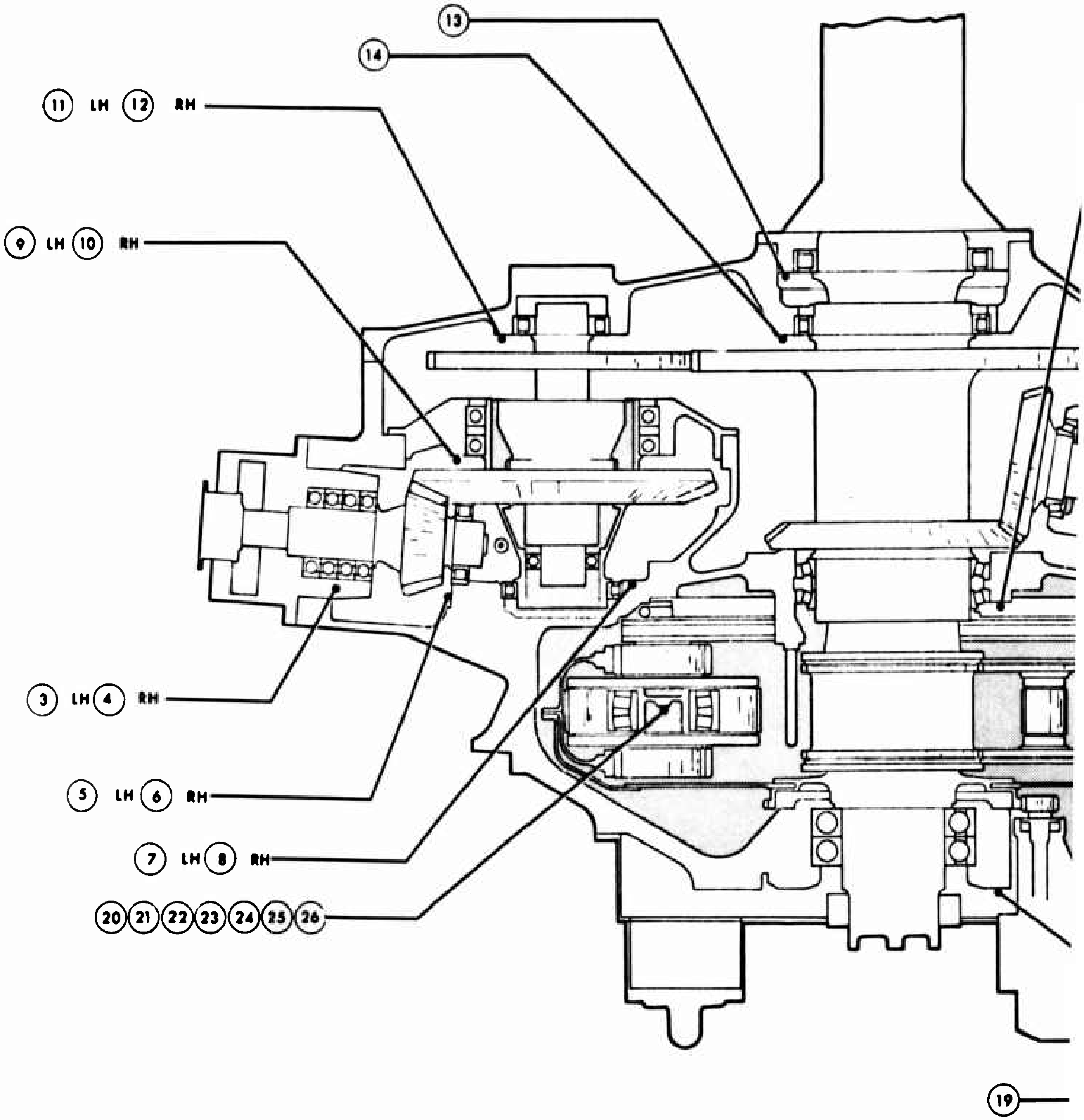
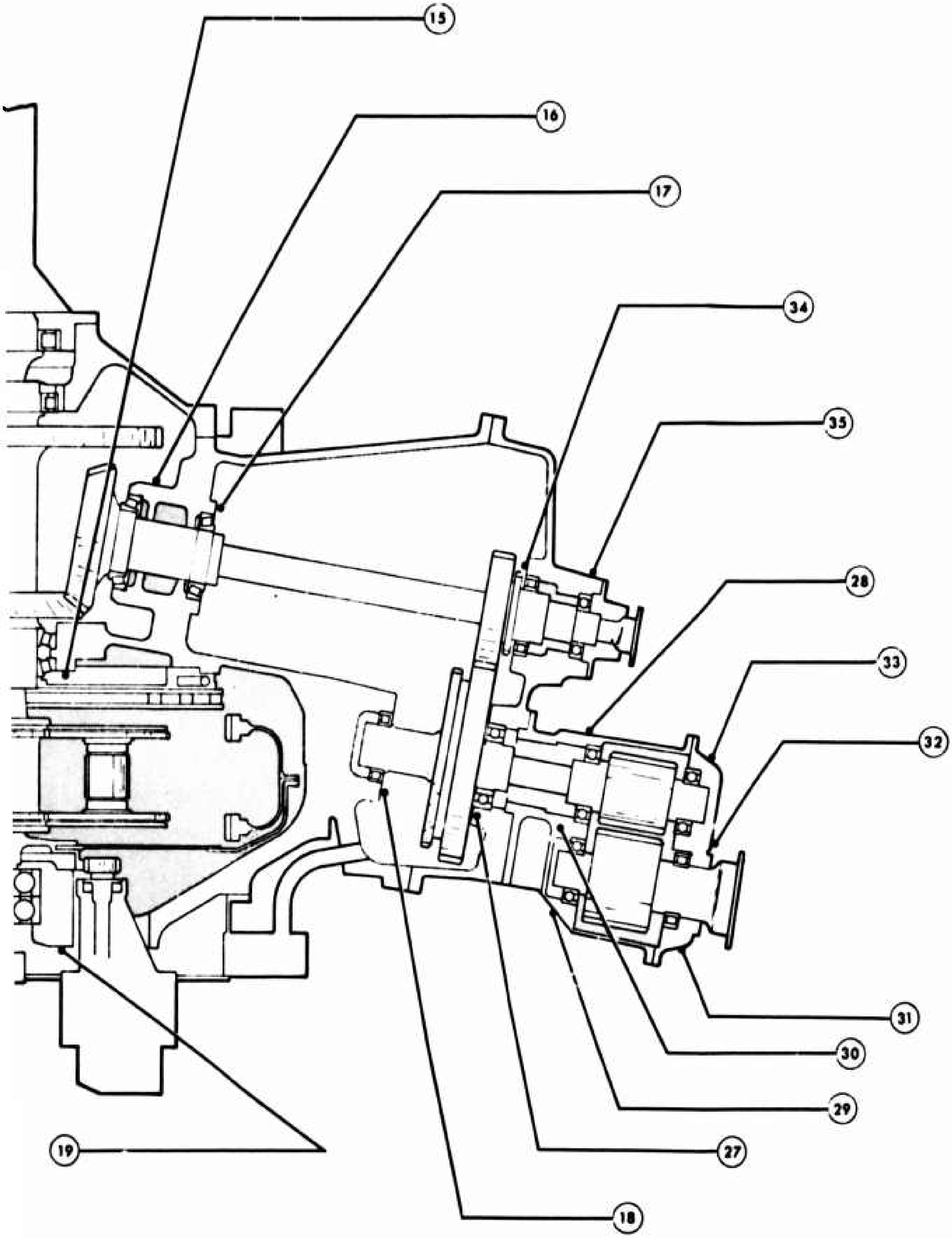


Figure 24. Thermocouple Locations - Roller Gear Transmission.



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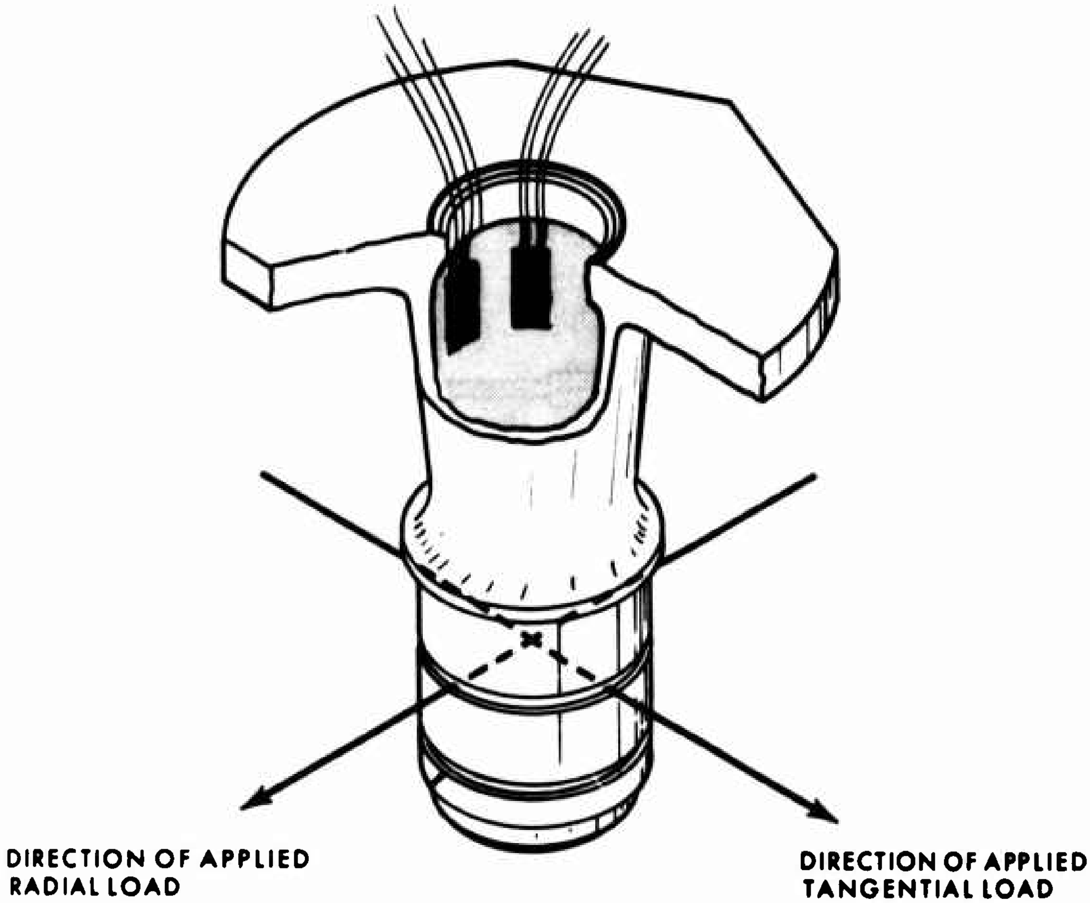


Figure 25. Strain Gage Locations - Post, Second-Row Pinion.

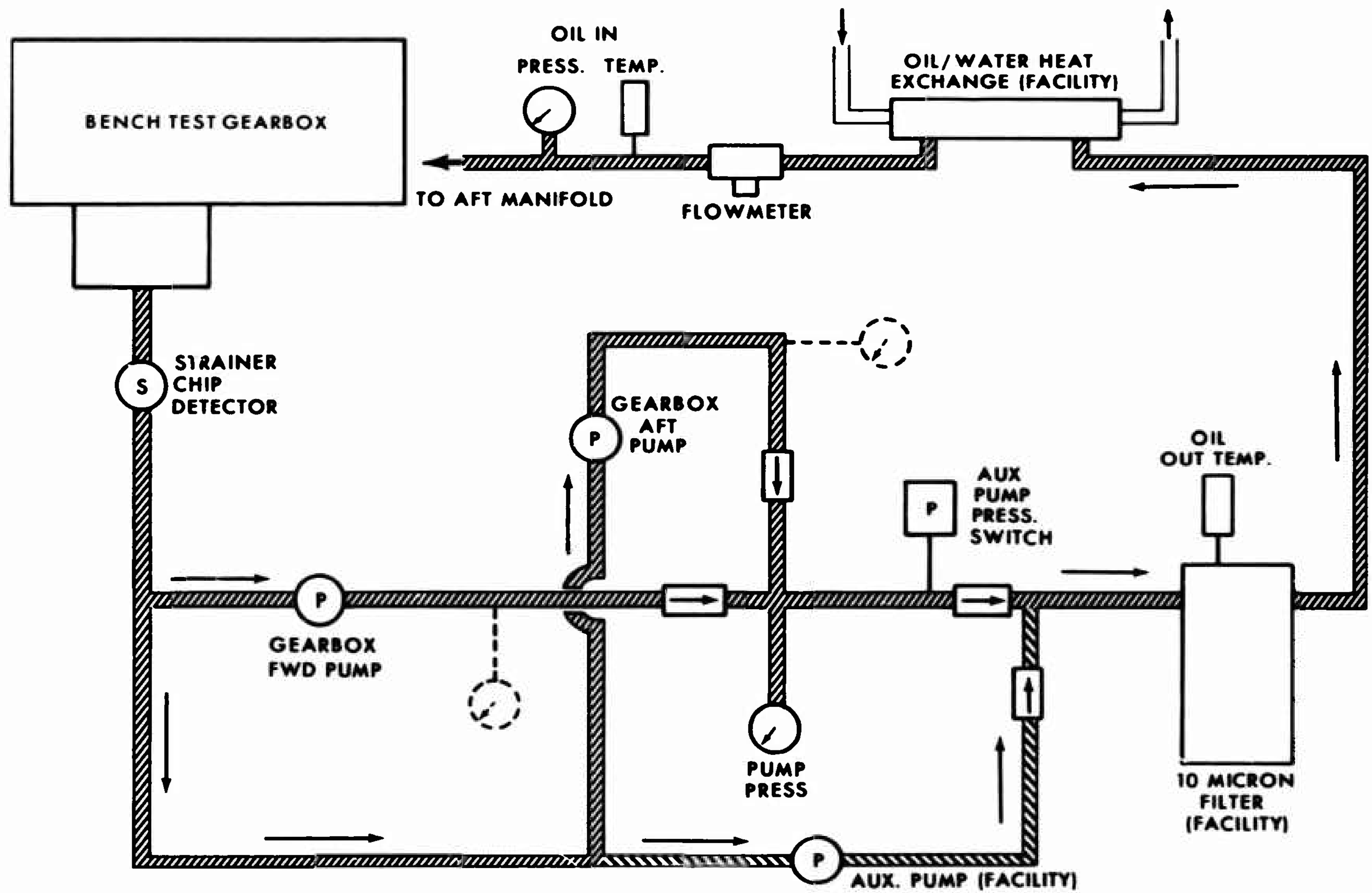


Figure 26. Lubrication System - Roller Gear Transmission.

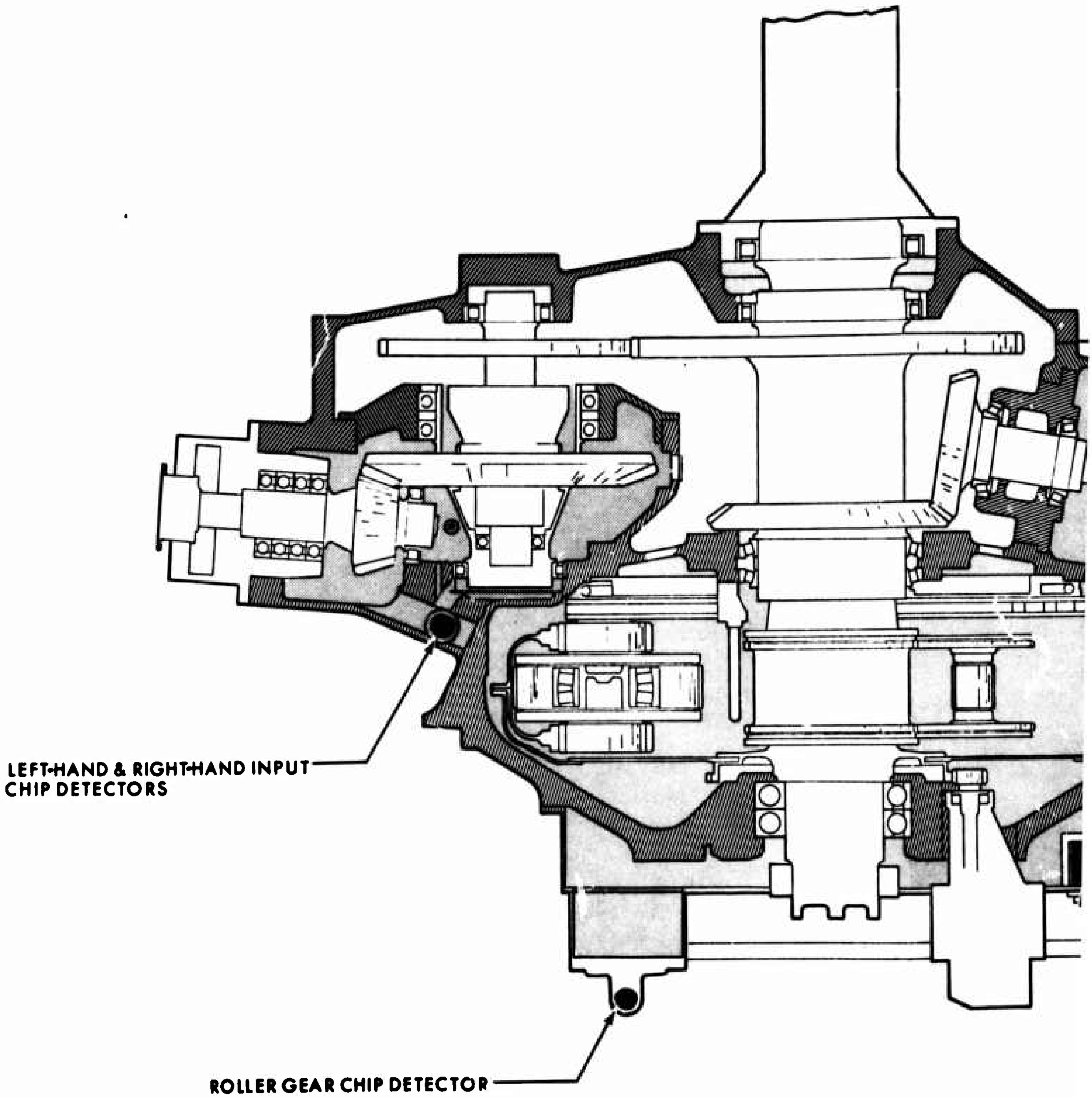
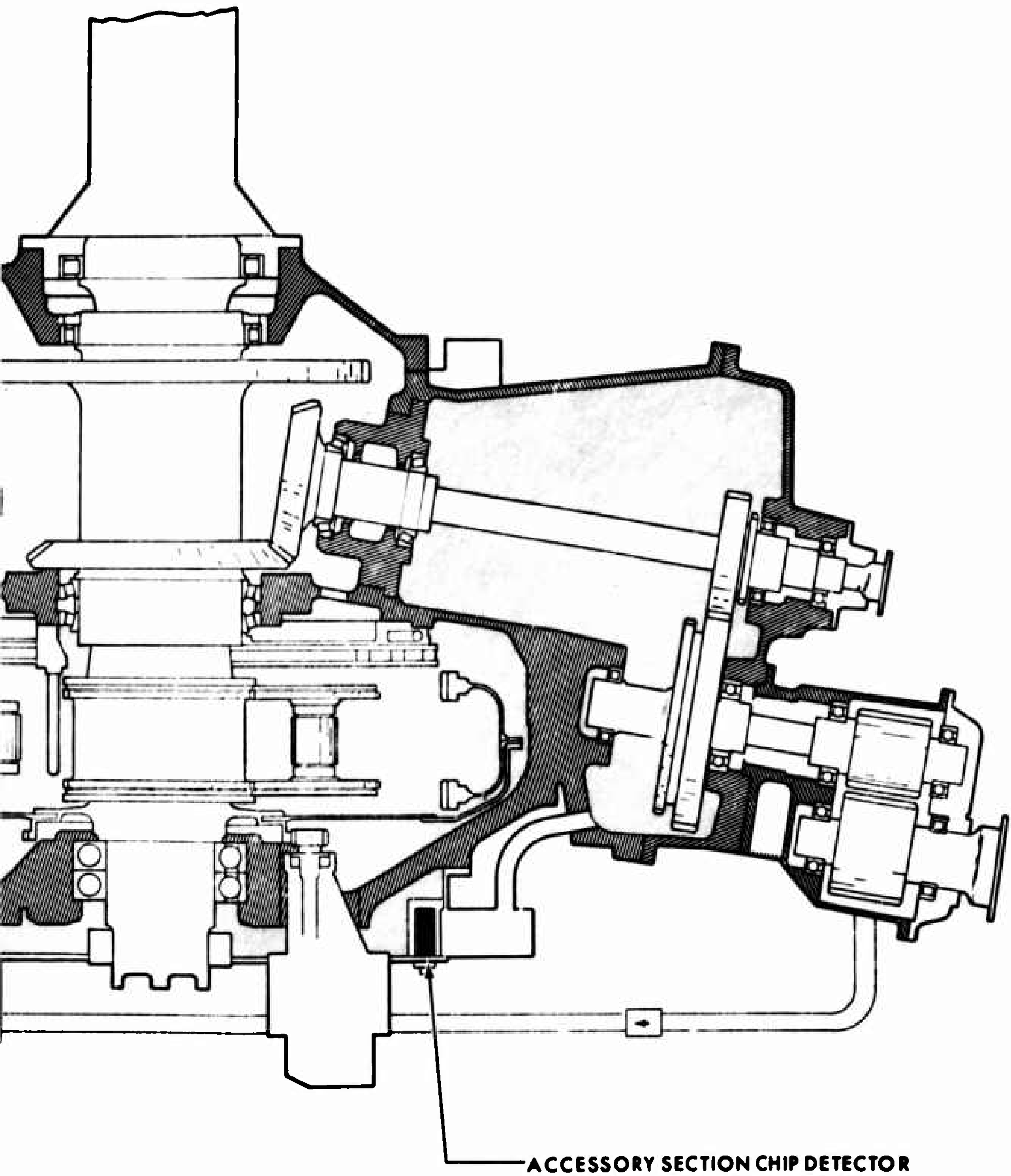


Figure 27. Chip Detector Locations - Roller Gear Transmission.



Transmission.

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BENCH TEST RESULTS

This chapter discusses the four phases of bench testing to which the roller gear drive transmission was subjected. During these tests, a total of 264 hours of testing was logged. Figure 28 shows a breakdown of the total test time into the four phases of bench testing including important shutdowns. The efficiency test, which is also included in this discussion, is not shown in the figure since it was conducted as part of the 200-hour endurance test.

NO-LOAD LUBRICATION TEST

The no-load lubrication test was conducted to evaluate the functional performance of the roller gear transmission and to ascertain the optimum lubrication system for the gearbox. The test was conducted to verify jet size, amount of oil required in the gearbox, and modifications to the gearbox necessary to ensure satisfactory lubrication and temperature levels. The initial lubrication system was based on analysis conducted during the design of the transmission.

Test Wagon, No-Load Test

The assembled dummy (slave) gearbox was installed on the test wagon in preparation for the no-load lubrication test. The dummy gearbox was selected as the test article for this series of tests as it did not contain freewheel units.

Figure 29 shows the input section of the dummy gearbox. The freewheel units, normally installed inside the vertical bevel gear shafts, are replaced by single-piece shafts. This ensures rotation of the input pinions when power is applied at any output shaft. Also shown in Figure 29 is an extension/adaptor on the input bevel pinion housing. This enables aircraft type drive shafts to be used to drive the test gearbox during subsequent testing to be conducted in the regenerative test stand.

The hydraulic motor was installed on the no-load lubrication rig and aligned with the tail takeoff flange, as shown in Figure 20 (test facility, no-load lubrication rig). All instrumentation was connected and checked out. The gearbox was serviced with 15 gallons of SATO 35 oil.

Testing was initiated at 20 percent operating speed, and incremental speed changes of 10 percent were conducted after partial temperature stabilization was reached. At 48 percent speed (100 percent speed = 3025 rpm), testing was discontinued because of drive motor flow limitations which prevented higher speeds. A hydraulic motor of greater flow capacity was installed. Testing was continued until a speed of 70 percent was attained, at which point testing again was discontinued

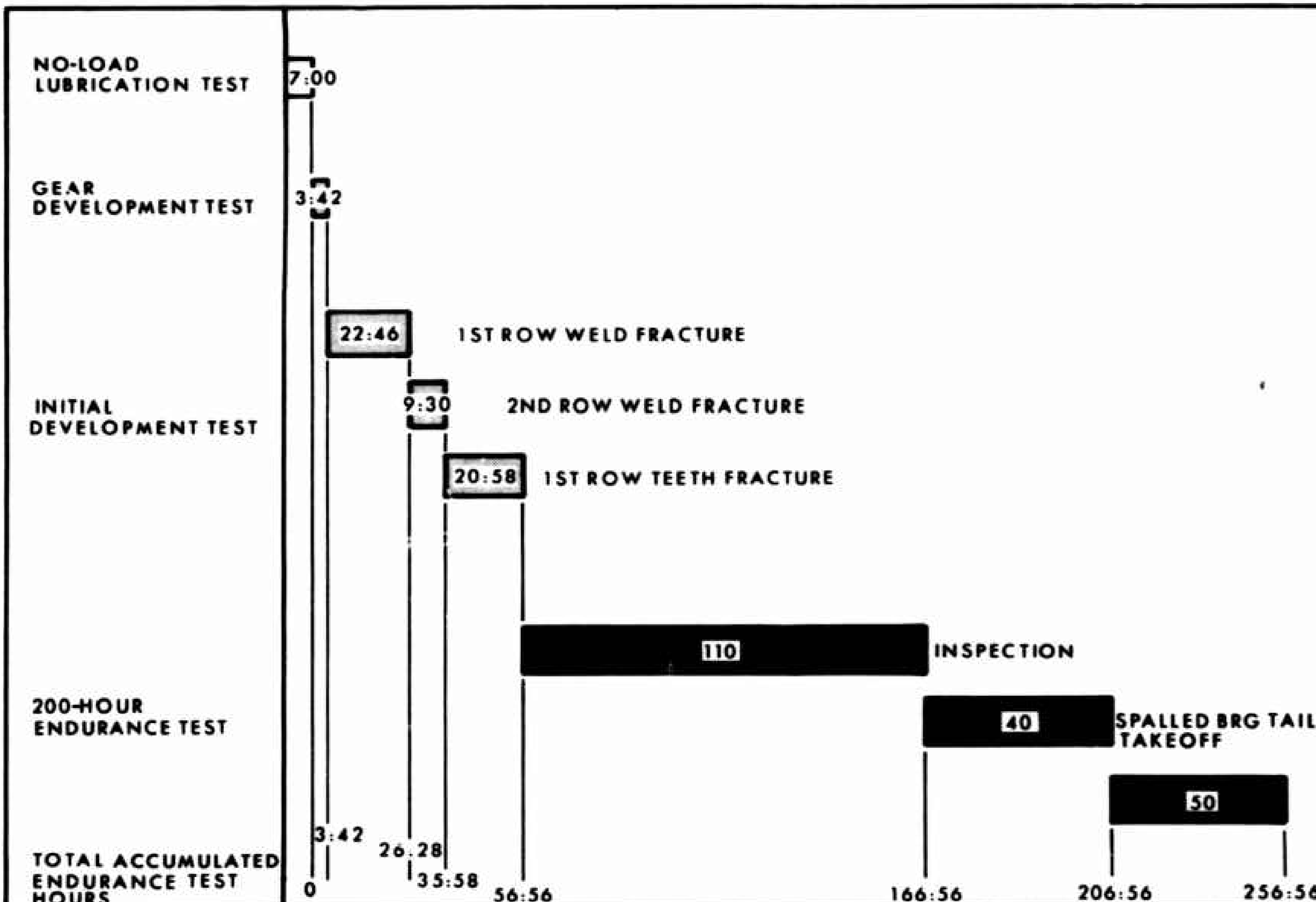


Figure 28. Bench Test Record.

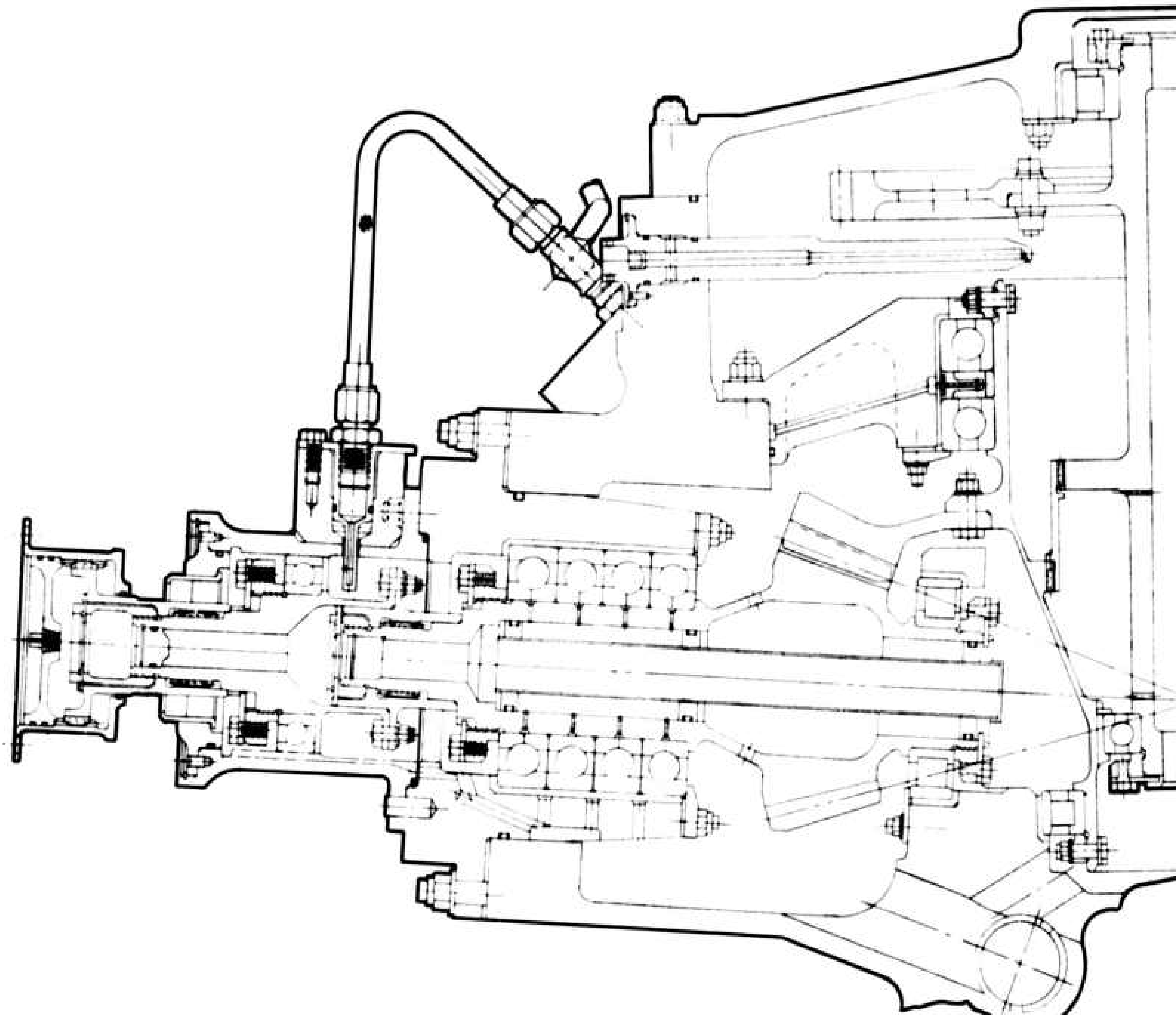
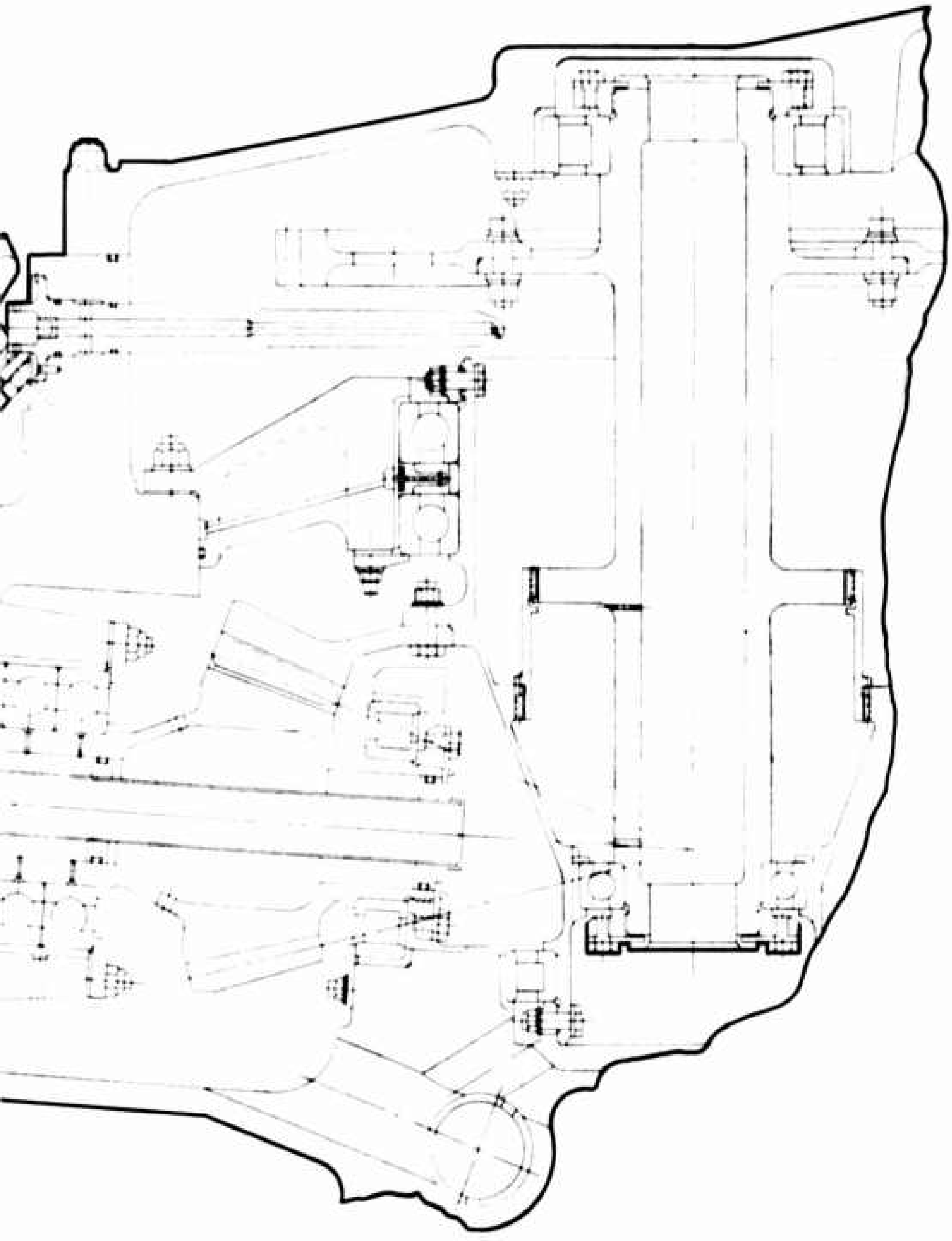


Figure 29. Input Section - Dummy Gearbox.



ny Gearbox.

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because of drive motor flow limitations.

It was noted during this series of tests that the inputs were operating at temperatures approximately 20¼°C higher than the remainder of the gearbox. No major problem was felt to exist at this time. This conclusion was based on the fact that all input temperatures stabilized and were identical at both the left-hand and right-hand sides.

Regenerative Test Facility, No-Load Test

Having attained a speed of 70 percent on the no-load lubrication test rig without experiencing any major problems, the decision was made to complete the test at 100 percent speed in the regenerative test facility. Initial testing in the regenerative stand was conducted at 50 percent speed to verify previous data and to check out compatibility of the gearbox with the stand. During this series of tests, drive power to the aircraft gearbox was transmitted through the main rotor shaft. The input drive shafts and the tail drive shaft were not installed. Minor compatibility difficulties with the gearbox instrumentation and the lubrication system plumbing with the regenerative test stand facility were resolved and the gearbox speed was increased to 100 percent. After obtaining stabilized readings of temperature, the effects of varying the amount of lubricant in the gearbox were evaluated under stabilized conditions. This permitted the selection of the oil level for the gearbox which achieved the best compromise between oil volume and stabilized gearbox temperatures. Testing was discontinued and the gearbox removed from the test stand when several small magnetic particles were found in the chip detector at the end of day inspection, Figure 30. There were insufficient particles to activate the warning light. Testing was resumed after a partial teardown and inspection. The source of the magnetic particles could not be determined, and it was concluded that they may have entered during the final assembly of the gearbox.

The input stack bearings, operating at a rotational speed of 18,966 rpm with a DN of 1,043,000, ran hotter than expected with a mean operating temperature of 118¼°C. Increasing the quantity of oil supplied to the bearings from 1.75 to 3.0 gallons per minute resulted in a temperature drop of only 3 degrees. Restricting the amount of oil conversely caused an increase in bearing temperature. Incorporating a shield around the input bevel pinion reduced the temperature of the stack bearings by 5¼°C and the bevel pinion roller bearing by 12¼°C. This shield, wrapped around the lower half of the gear and following the contour with 0.12 inch clearance as shown in Figure 31, allows the oil to drain freely from the stack bearings and the input housing.

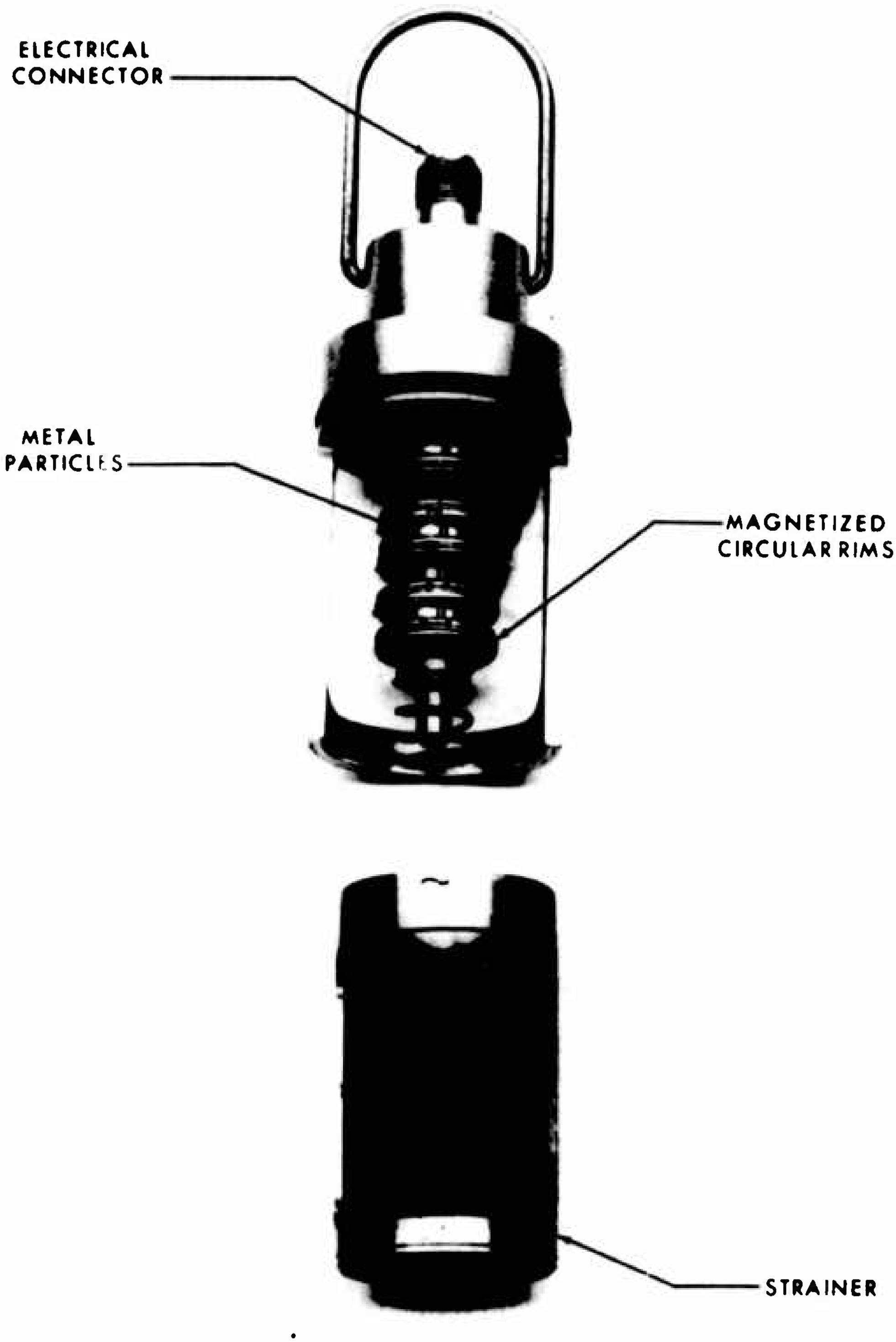


Figure 30. Chip Detector, No-Load Lubrication Test.

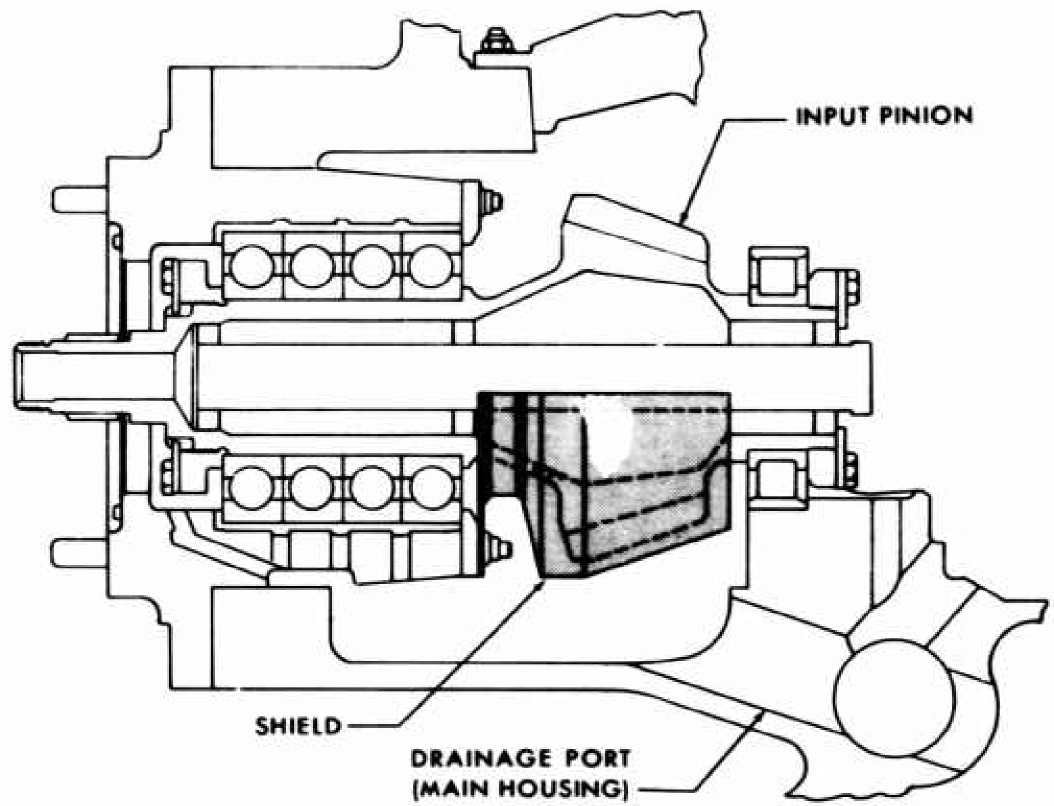


Figure 31. Input Bevel Pinion Shield.

The duplex bearings on the bevel gear shaft operate at a DN of 1,180,000, the highest in the gearbox. Lubrication to these bearings is supplied from a probe jet located between the bearings which directs oil to the inner raceways of each bearing. These bearings also ran hotter than anticipated at a temperature of 125° C. It was theorized that oil was accumulating around the bearing housing, thereby causing excessive heat as a result of churning. Oil lubricating the bevel gear mesh is forced outward by the rotation of the gear, thus creating a wall of oil which prevents the oil supplied to the bearings from draining. To alleviate this problem, drainage holes were machined in the main housing to allow the oil to escape, Figure 32.

Testing with 17 gallons of oil was terminated after 50 minutes when, after stabilization of temperatures, the temperatures of the spherical bearings in the roller gear unit output gears suddenly rose 20 degrees to a mean of 102° C. Accompanying this rise was an increase in friction horsepower. It was theorized that insufficient oil drainage in the roller gear unit caused a high dynamic oil level which extended into the roller gear assembly. The output ring gear of this unit acts as a collector for the oil and allows a head of oil to build up before it can bleed out. Within the head of oil, the second-row pinion gears operate, continuously churning the oil and thereby generating heat. It was apparent that better drainage of the oil collected by the ring gear was required. Holes in the vertical portion of the ring gear web were drilled to allow the oil to drain.

The rear cover casing containing the tail takeoff spur gears and accessory drive spur gears, whose bearings are gravity fed by oil collected in scuppers, experienced no problems; nor was there any excessive heat generated in the adaptor gearbox by the 3.37-inch-wide spur gears.

The final inspection included a complete disassembly of all the gearbox subassemblies. No sign of any malfunction was detected.

Test Results

The tests revealed that 14.5 gallons was the optimum amount of oil for the gearbox. This quantity of oil prevented cavitation in the two-vane type lubrication pumps, yet did not create excessive churning losses within the gearbox. The oil temperature increase for the gearbox with this quantity of oil is 27° C for an oil-in temperature of 70° C and oil-out temperature of 97° C. Pump cavitation occurred at oil levels less than 13 gallons. Various tests were conducted to determine if oil flow fluctuations were being caused by an insufficient oil recovering rate. However, tests conducted by-passing

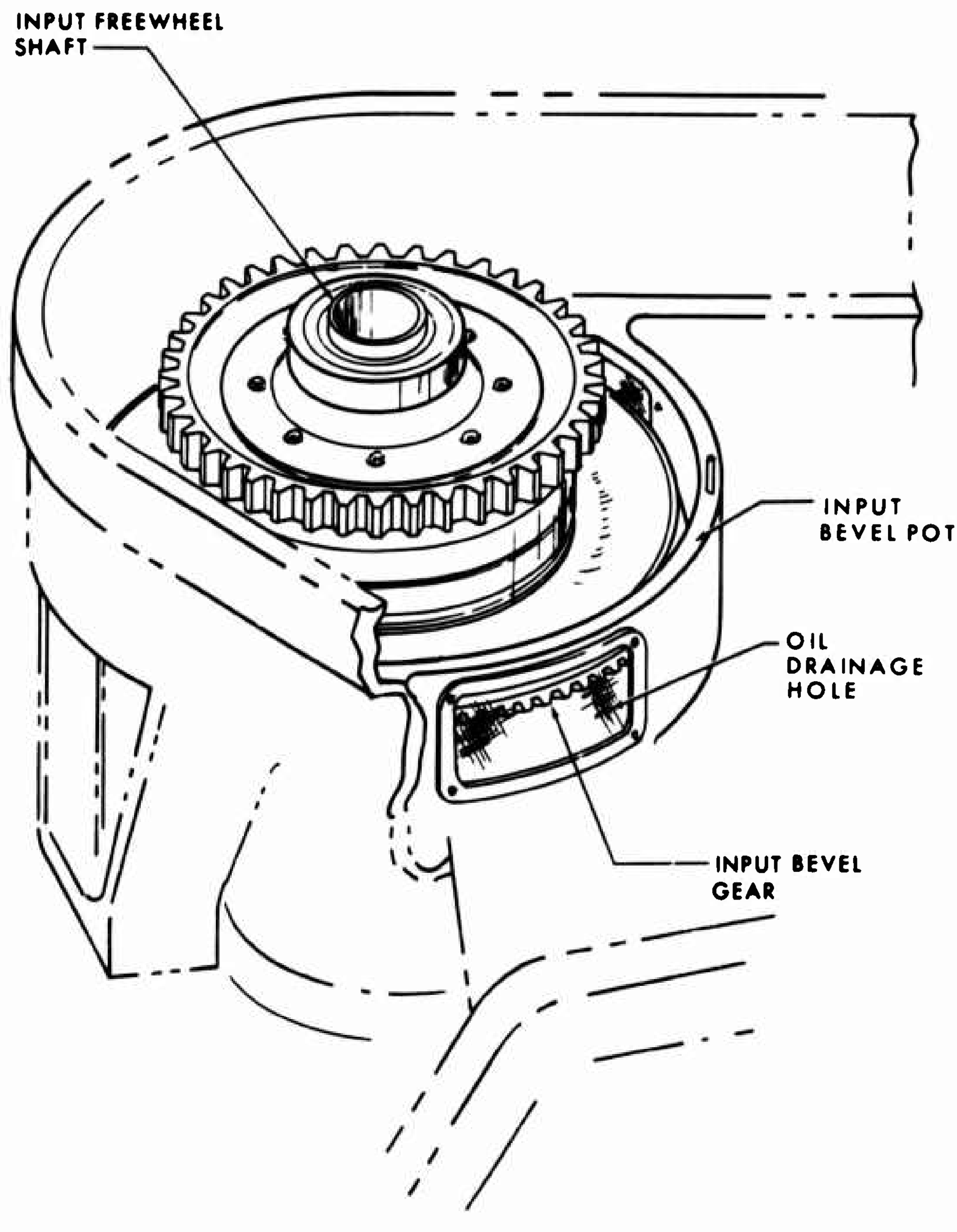


Figure 32. Drainage Ports - Input Bevel Gear Housing.

restrictive areas of the oil path had no effect.

Figure 33 shows both static and operating levels of 14.5 gallons of oil in the gearbox. With an initial 14.5 gallons of oil in the gearbox, the quantity that remains trapped after drainage is 2.5 gallons.

Gearbox Modifications

As a result of the tests, the following modifications were incorporated in both the dummy gearbox, on which the no-load test was conducted, and the test gearbox, which was in the process of being assembled:

Main housing - drainage holes machined in the input bevel pots and screens incorporated as shown in Figure 33. Mesh type screens with chip detectors incorporated in the center membrane of the main housing.

Ring gear output flange assembly - 0.5-inch-diameter holes machined in the ring gear and output flange as shown in Figure 34.

Lower housing sump - four drain back lines incorporated (Figure 34).

Input pinions - shields incorporated (Figure 31).

The inclusion of screens in the input bevel pots and center membrane compartmentalizes the gearbox into six units as shown in Figure 35. These incorporate the following gear meshes:

1 & 2 The left-hand and right-hand input bevel pinion and gear assemblies.

3 The combining spur gears and tail takeoff bevel gears.

4 The roller gear unit and sump pump drive gears.

5 The accessory section.

6 The adaptor gearbox.

The gearboxes now incorporating four magnetic chip detectors and eight plug type detectors (incorporated in the center membrane screen baskets) enable the location of any failure to be accurately determined.

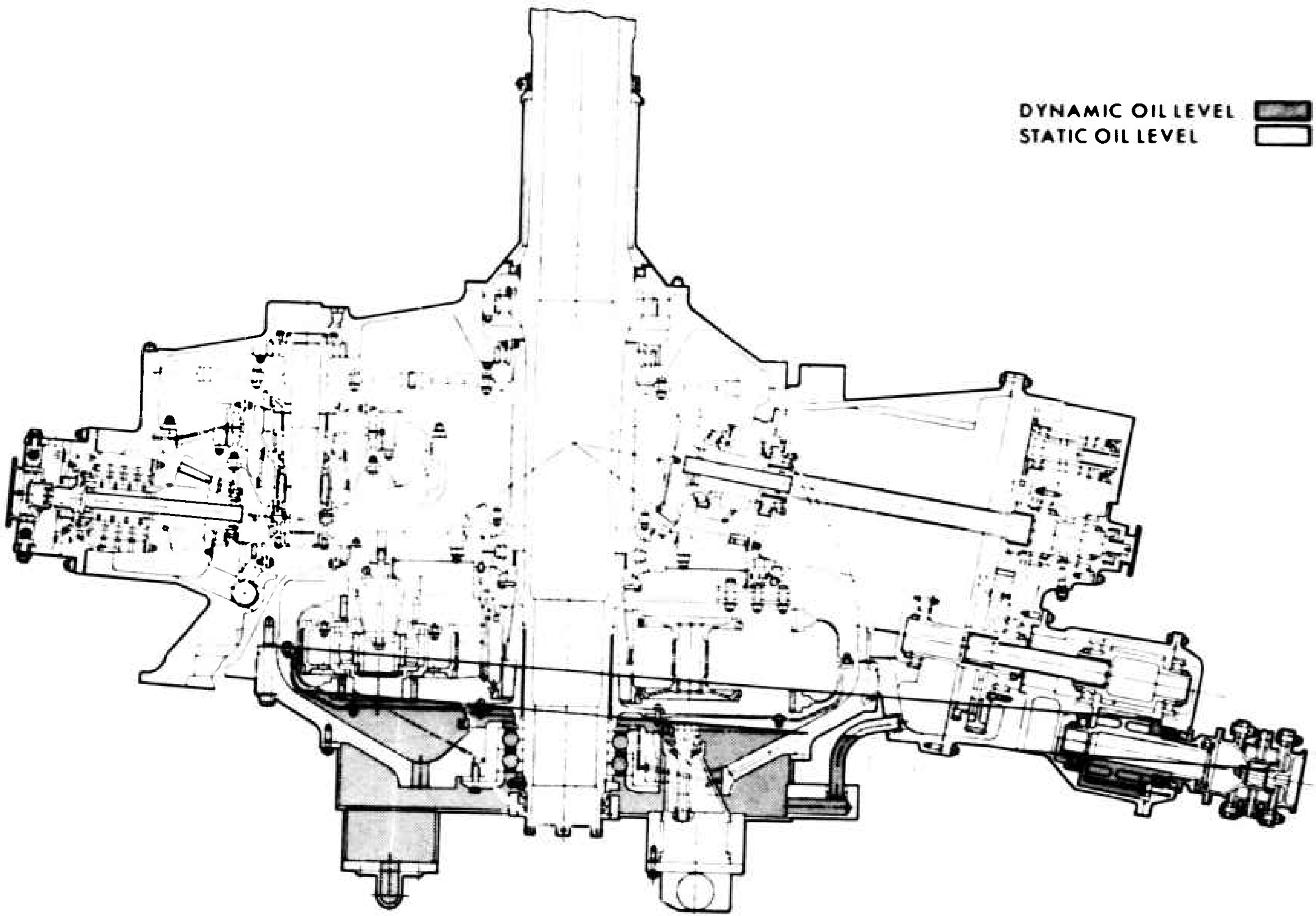


Figure 33. Oil Levels - Roller Gear Transmission.

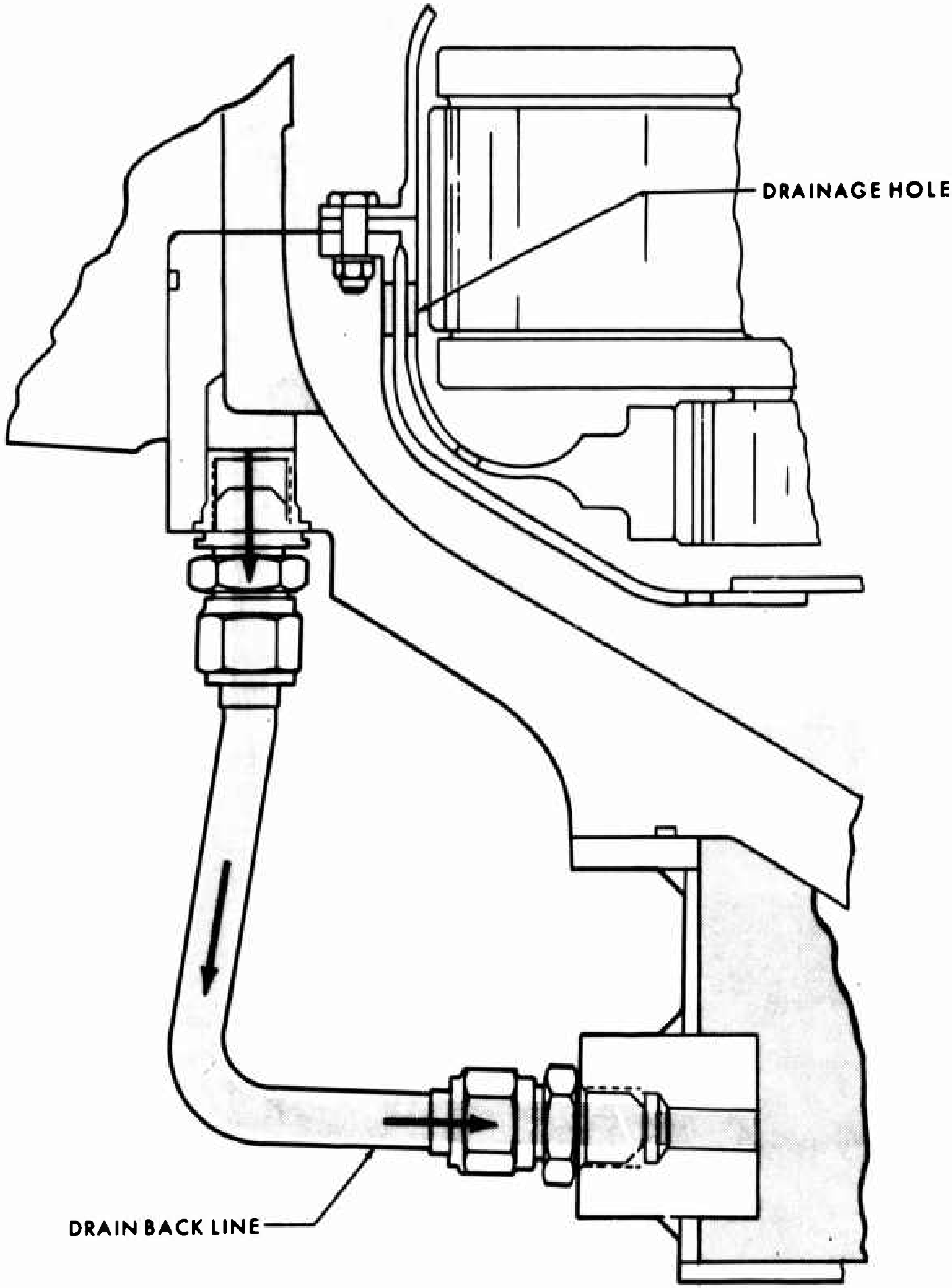


Figure 34. Oil Drainage - Ring Gear/Lower Housing.

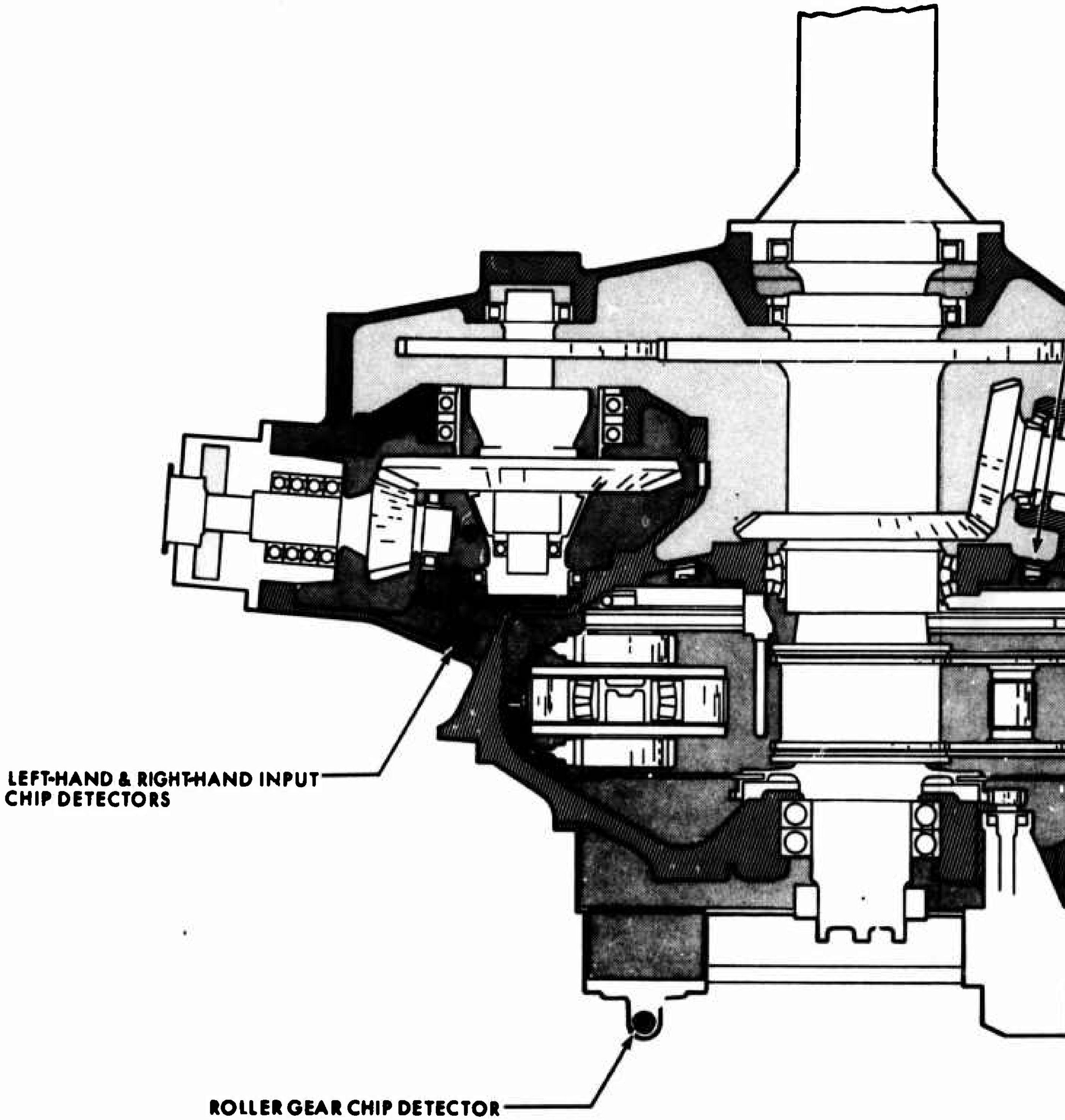
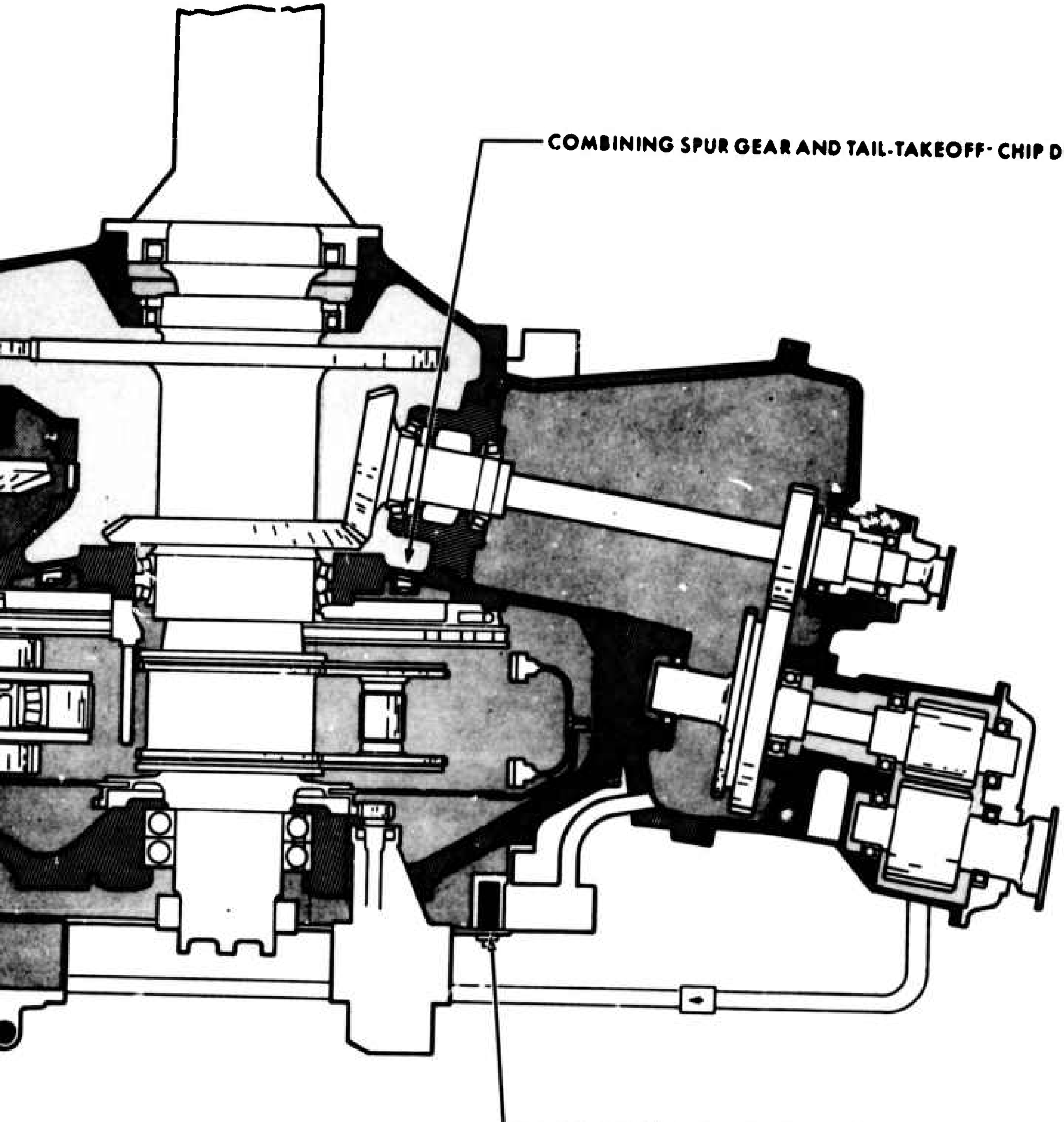


Figure 35. Compartmentalization - Roller Gear Transmission.



ear Transmission.

10

GEAR PATTERN DEVELOPMENT TEST

The purpose of the gear pattern development test was to establish satisfactory gear patterns on the tail takeoff and input bevel gear sets and to determine the dynamic characteristics of the roller gear transmission.

Included in the preparation for the gear pattern development test was the calibration of the second-row pinion bearing posts and the main rotor shaft. The posts (seven per gearbox) were calibrated with the use of Wheatstone bridge strain gages bonded on the inside bore of the posts, as shown in Figure 25. A tangential load of 10,000 pounds and a radial load of 500 pounds were applied to each of the posts by means of a hydraulic cylinder as shown in Figure 36. By measuring the change in voltage across the strain gages, a relationship between voltage change and load was determined, thereby enabling loading characteristics of the posts to be monitored.

Calibration of the strain gages of the main rotor shaft was performed in a similar manner. A torque of 950,000 in.-lb was applied to the main rotor shaft by two hydraulic rams, as shown in Figure 37, and reacted by restraining the input shafts. Voltage changes across strain gages mounted on the inside of the rotor shaft were monitored and related to the applied torque. This enabled the torque through the main rotor shaft to be determined at any time by examination of the strain gage output voltage.

The roller gear units for the test and dummy transmissions were assembled with those components listed in Tables VII and VIII, respectively. These tables show the status and total number of test hours accrued for each part. Figures 38 and 39 show the location of the gears in the test and dummy roller gear units. Thermocouples attached to the posts as shown in Figure 40 and numbered T21 through T26 were used to measure the temperatures of the bearings in the second-row pinions. These temperatures are recorded on the run sheets given in Appendix I. These sheets are records of the data listed in the instrumentation section of this report for this test and subsequent tests.

Figure 41 shows the partially assembled roller gear unit with the top half of the double plate removed, exposing the flanges of the second-row pinion posts.

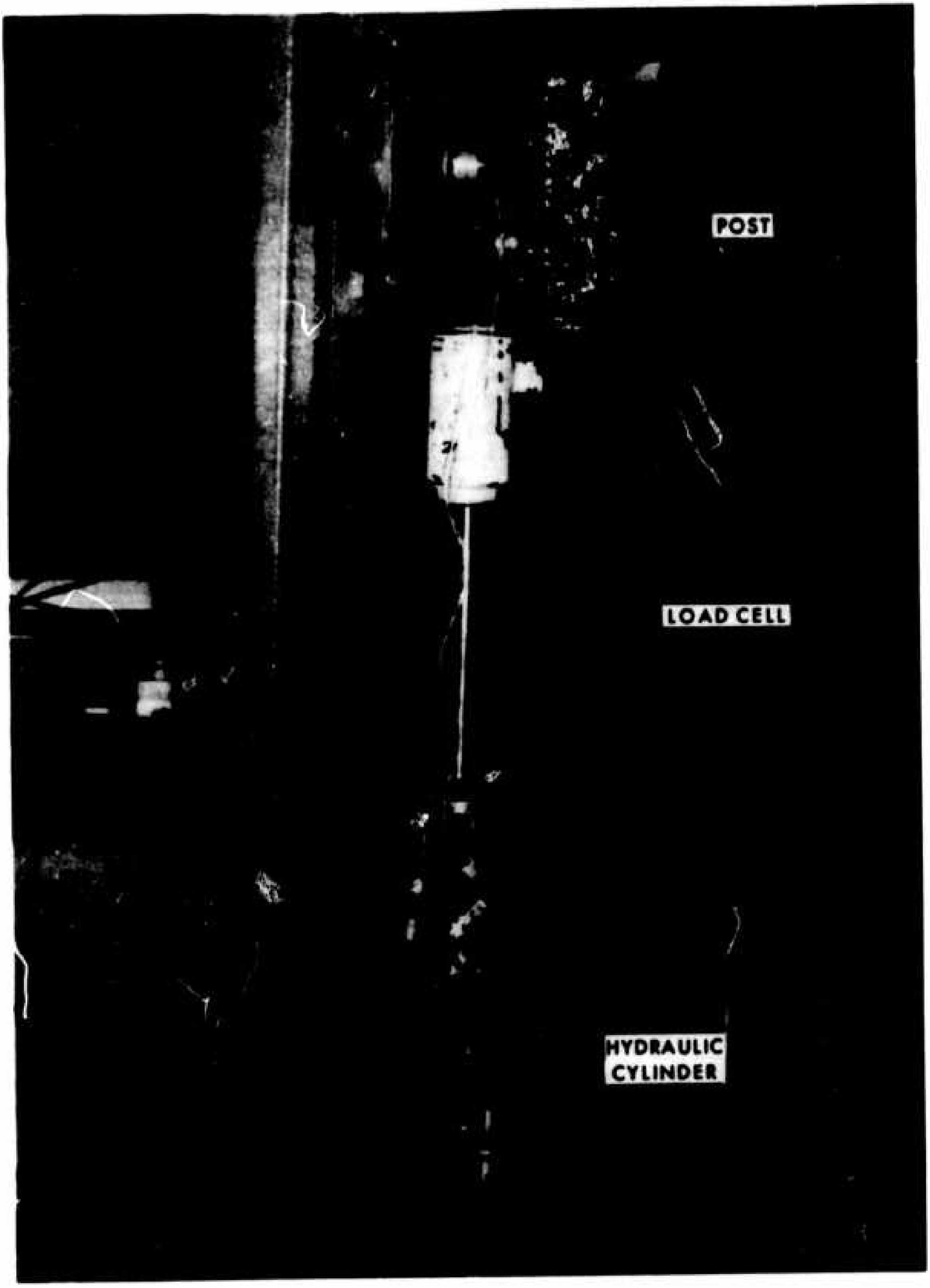


Figure 36. Static Calibration - Second-Row Pinion Posts.

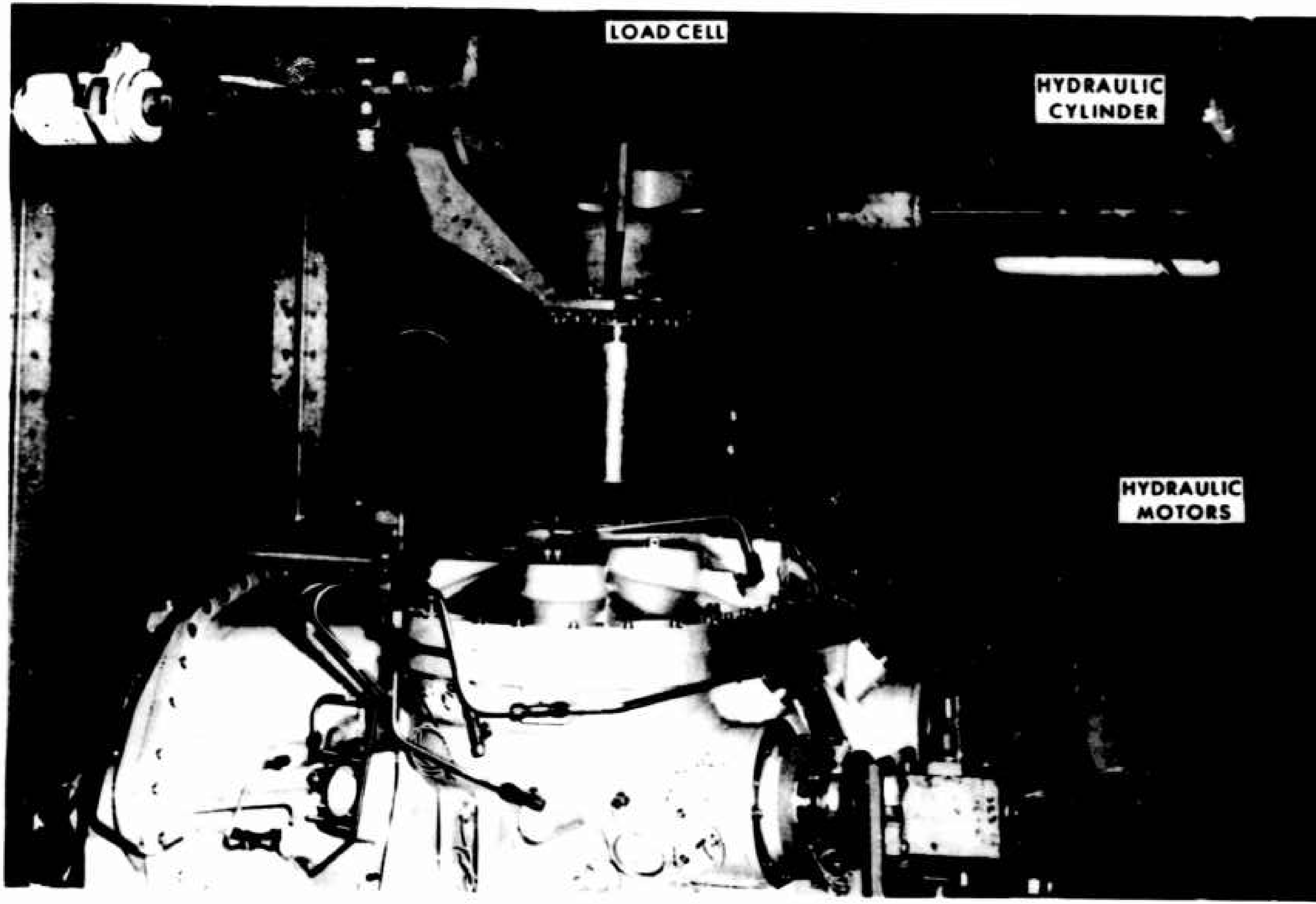


Figure 37. Static Calibration - Roller Gear Transmission.

TABLE VII. TEST #1 - ROLLER GEAR COMPONENTS - TEST GEARBOX

Part Number	Nomenclature	Serial Number	Status	Test (hours:minutes)
RG351-11183-041	Sun Gear	04	New	0
RG351-11182-042	1st-Row Pinion	05	New	0
RG351-11182-042	1st-Row Pinion	11	New	0
RG351-11182-042	1st-Row Pinion	12	New	0
RG351-11182-042	1st-Row Pinion	13	New	0
RG351-11182-042	1st-Row Pinion	14	New	0
RG351-11182-042	1st-Row Pinion	15	New	0
RG351-11182-042	1st-Row Pinion	17	New	0
RG351-11181-042	2nd-Row Pinion	03	New	0
RG351-11181-042	2nd-Row Pinion	04	New	0
RG351-11181-042	2nd-Row Pinion	05	New	0
RG351-11181-042	2nd-Row Pinion	06	New	0
RG351-11181-042	2nd-Row Pinion	08	New	0
RG351-11181-042	2nd-Row Pinion	09	New	0
RG351-11181-042	2nd-Row Pinion	20	New	0
RG351-11184-041	Ring Gear	02	New	0
LP-1313-UHAR-3906	Compliant Bearing	7	New	0
LP-1313-UHAR-3906	Compliant Bearing	13	New	0
LP-1313-UHAR-3906	Compliant Bearing	14	New	0
LP-1313-UHAR-3906	Compliant Bearing	52	New	0
LP-1313-UHAR-3906	Compliant Bearing	58	New	0
LP-1313-UHAR-3906	Compliant Bearing	59	New	0
LP-1313-UHAR-3906	Compliant Bearing	60	New	0

TABLE VIII. TEST #1 - ROLLER GEAR COMPONENTS - DUMMY GEARBOX

Part Number	Nomenclature	Serial Number	Status	Test (hours:minutes)
RG351-11183-041	Sun Gear	06	New	0
RG351-11182-042	1st-Row Pinion	01	New	0
RG351-11182-042	1st-Row Pinion	04	New	0
RG351-11182-042	1st-Row Pinion	06	New	0
RG351-11182-042	1st-Row Pinion	07	New	0
RG351-11182-042	1st-Row Pinion	08	New	0
RG351-11182-042	1st-Row Pinion	09	New	0
RG351-11182-042	1st-Row Pinion	10	New	0
RG351-11181-042	2nd-Row Pinion	01	New	0
RG351-11181-042	2nd-Row Pinion	10	New	0
RG351-11181-042	2nd-Row Pinion	15	New	0
RG351-11181-042	2nd-Row Pinion	16	New	0
RG351-11181-042	2nd-Row Pinion	17	New	0
RG351-11181-042	2nd-Row Pinion	19	New	0
RG351-11181-042	2nd-Row Pinion	23	New	0
RG351-11184-041	Ring Gear	04	New	0
22313VAG	Spherical Bearing	N2	New	0
22313VAG	Spherical Bearing	N10	New	0
22313VAG	Spherical Bearing	N15	New	0
22313VAG	Spherical Bearing	N25	New	0
22313VAG	Spherical Bearing	N26	New	0
22313VAG	Spherical Bearing	N31	New	0
22313VAG	Spherical Bearing	N45	New	0

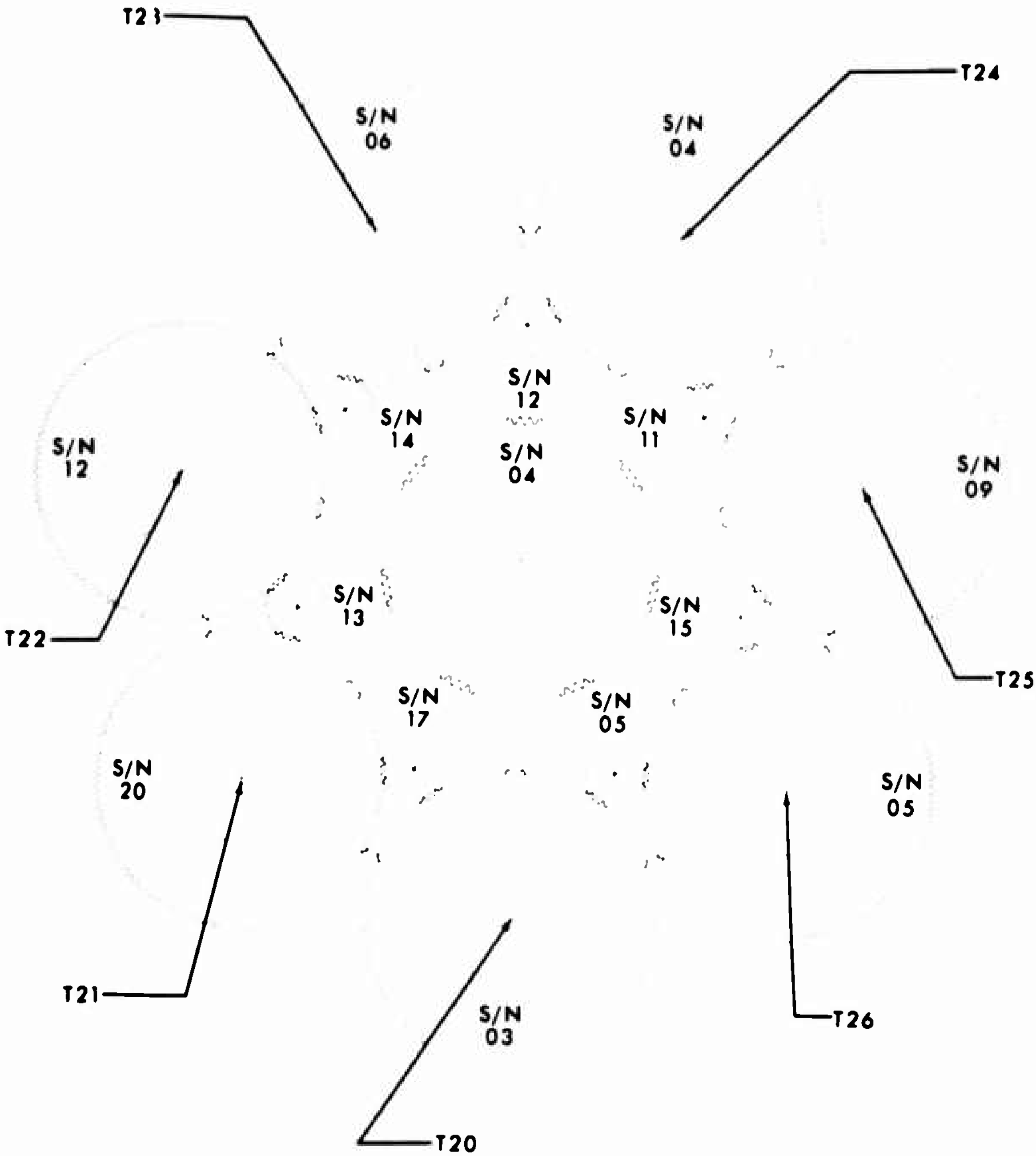


Figure 38. Component Location - Test Roller Gear Unit.

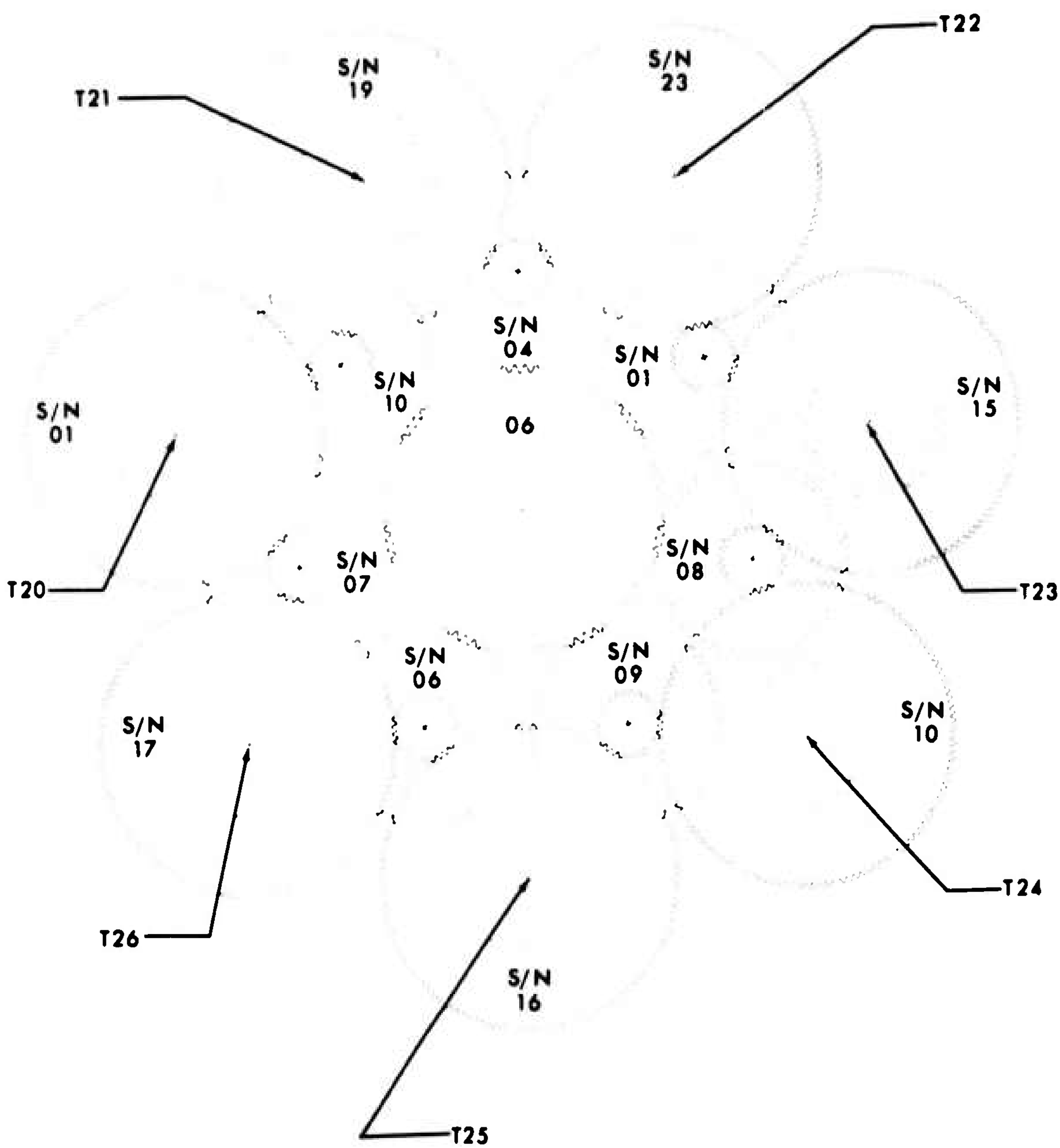


Figure 39. Component Location - Dummy Roller Gear Unit.

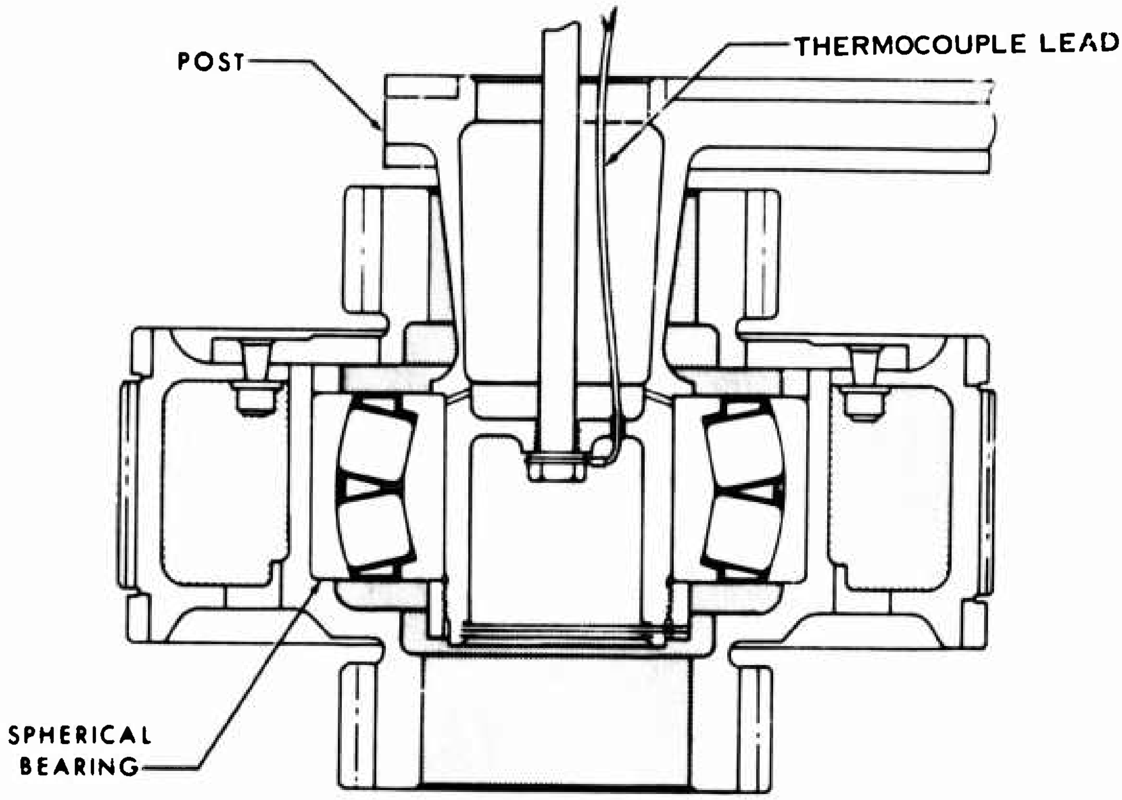


Figure 40. Thermocouple Installation - Second-Row Pinion Post.

Figure 41. Roller Gear Drive Assembly - Test Gearbox.

The test gearbox was installed in the regenerative test stand and checked out in a manner similar to the tests conducted on the dummy gearbox during the no-load lubrication test. The dummy gearbox, upon completion of the internal modifications performed after the no-load lubrication test and the calibration of the main rotor shaft, was installed in the test stand with the test gearbox as shown in Figure 22. An input drive shaft was installed between the test and dummy gearboxes as shown in Figure 42. The input drive shaft contains pole pieces (see Figure 42) that are used in measuring the torque transmitted through the rotating shaft when under load. When the shaft is subjected to torque, one end of the shaft is deflected relative to the other end. This difference in torsional deflection is measured by means of a magnetic pickup which detects the relative displacement of the pole pieces. To accomplish this with a single pickup, the pole pieces are cantilevered from each end of the shaft and are free floating. The pole pieces are of ferrous material to induce a signal in the pickup. The signal from the pickup is then conditioned into an analog output proportional to shaft twist and displayed on an indicating system.

The natural frequency of the installed interconnect shaft (Figure 42) was determined by conducting a "rap" test. This test consisted of installing a small crystal accelerometer to the mid-span of the shaft, the output of which was recorded with a light beam oscillograph. A 60 Hertz reference trace is used as a time base. The shaft was "rapped" and the resulting output of the accelerometer was a trace of the natural frequency in a decaying curve. The frequency of the accelerometer was compared with the 60 Hertz reference trace to determine the frequency of the first shaft critical mode. Operation of this shaft was determined to be unacceptable at 100 percent speed because the shaft critical mode was found to be within 3 percent of the operating speed. However, to expedite the bevel gear pattern development tests, testing with this shaft was permitted to a maximum of 50 percent speed.

In order to check out the test stand, both gearboxes were run for 1 hour and 18 minutes (0 - 1:18 total test time) with no input shafts. After the installation of the drive shafts, as described above, the gearboxes were run for 47 minutes at 50 percent speed. At 2:05 test hours, the test stand was shut down for visual inspection of the input bevel gear patterns through the ports. However, shields incorporated as a result of the no-load lubrication test hindered inspection. The test stand was immediately restarted and run at 50 percent speed; at 2:20 test hours the test stand was then shut down.

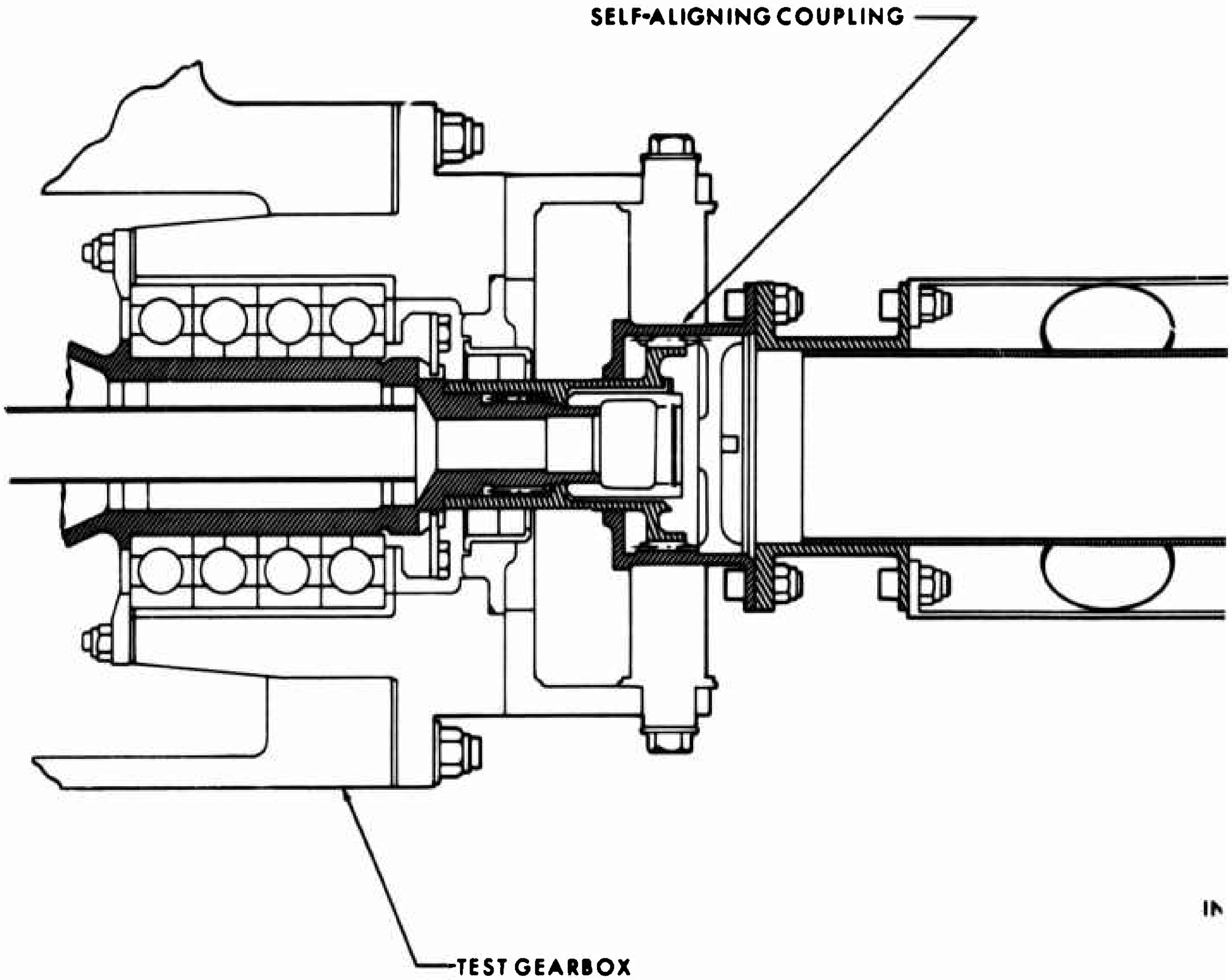
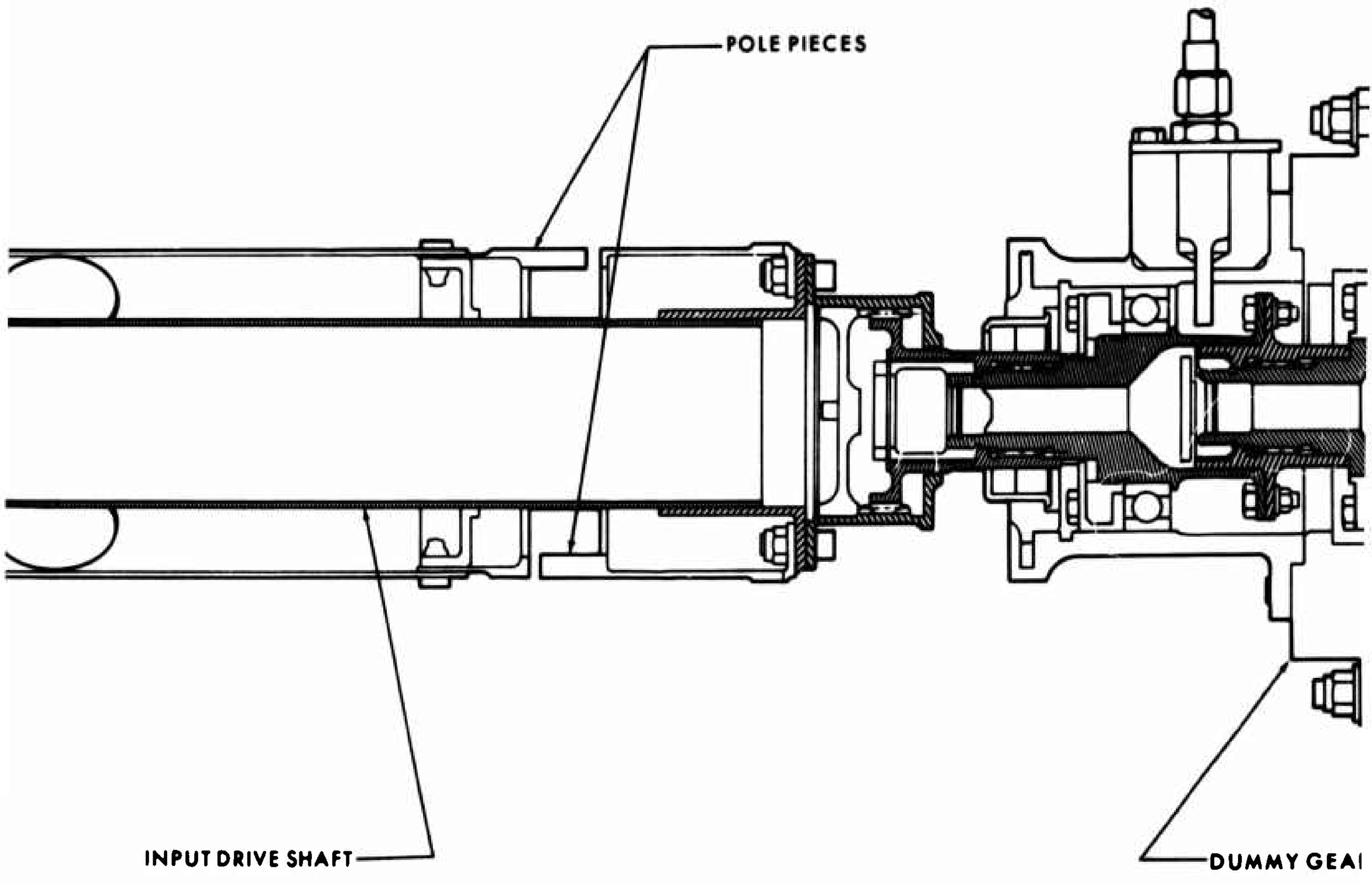
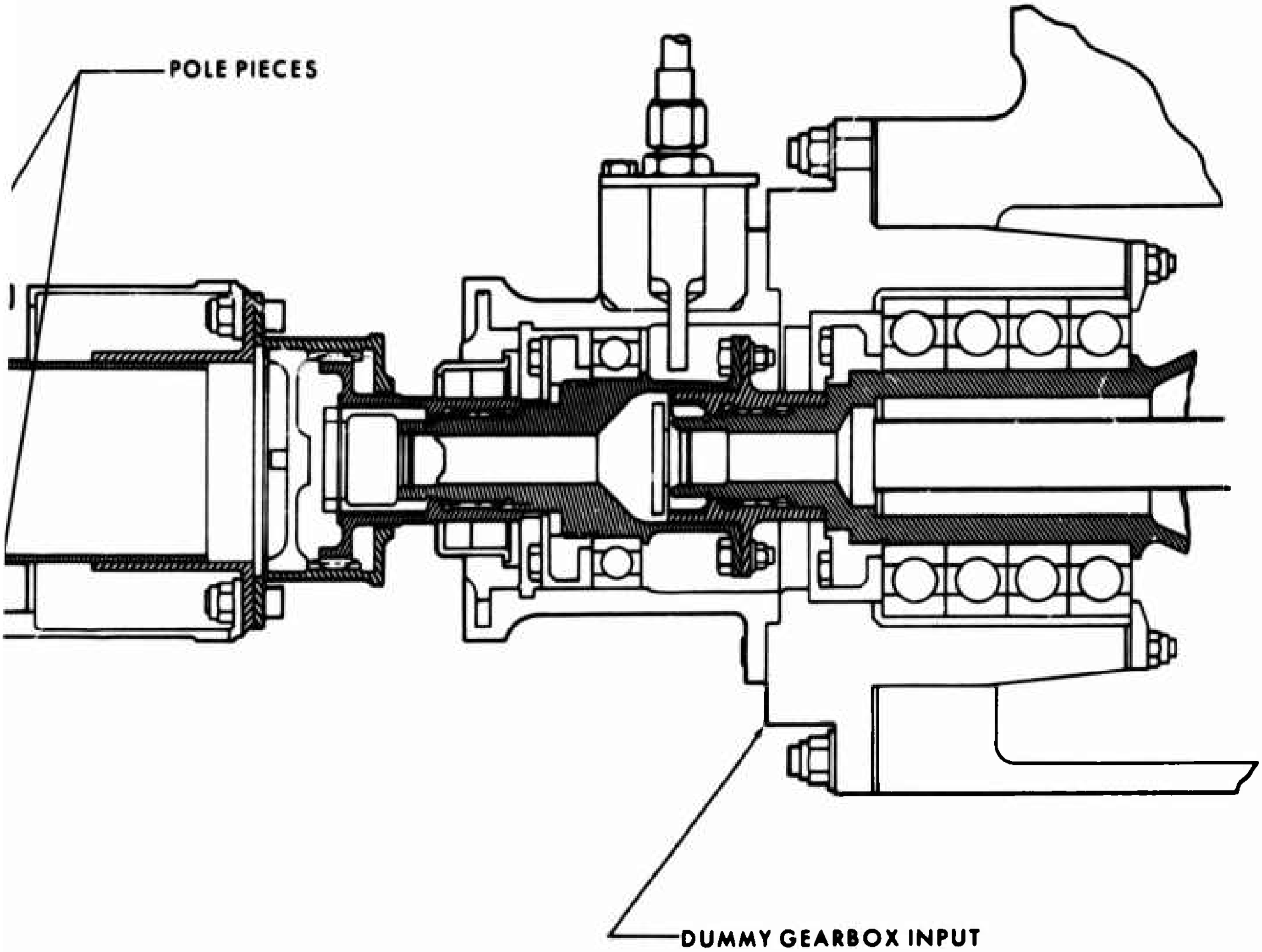


Figure 42. Drive Shaft Installation - Regenerative Test Stand.


POLE PIECES
INPUT DRIVE SHAFT
DUMMY GEA



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To overcome the 50-percent speed limitation, a redesigned input drive shaft was fabricated. This new shaft, Figure 43, eliminates the cantilevered pole pieces, thereby reducing the weight of the shaft. A "rap" test of this configuration indicated critical speed to be acceptably high at 130 percent operating speed. In order to adjust the test facility for an equal torque split between the two input shafts, a new torque measuring system had to be devised for the drive shafts because of the removal of the pole pieces. This was accomplished by the bonding of Wheatstone bridge strain gages on the inside diameter of the drive shafts. Torque was applied to the system and measured statically. It was adjusted by "slipping" the proper coupling until a satisfactory torque balance was achieved.

With both redesigned shafts installed and an equal torque split established between the input shafts, gear pattern development testing was continued. In a series of incremental steps, load was increased up to a total input power of 3000 hp at the test main rotor shaft while operating at 100 percent speed (2:26 - 2:32 test hours).

The tail drive shaft torque loop was connected, and a series of incremental load changes up to 500 hp was conducted to establish tail takeoff bevel gear patterns and to check out the tail loop of the facility (2:32 - 3:42 test hours). At the completion of this series of tests both gearboxes were removed from the test stand for disassembly and inspection.

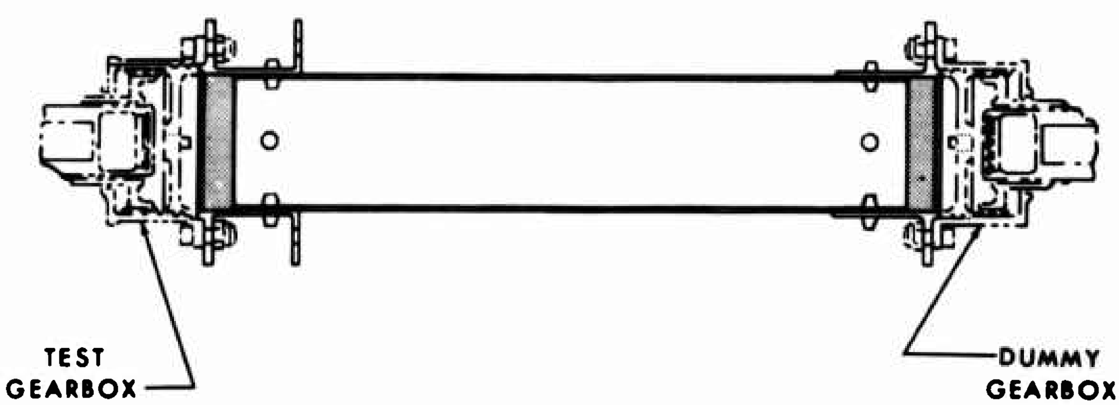


Figure 43. Strain Gaged Drive Shaft.

Test Results

The input bevel pinions exhibited a hard line in the root of the gear teeth, the result of insufficient chamfer on the edge of the bevel gear teeth. These teeth were dressed with 0.010/0.015 inch chamfer, thereby alleviating this problem. Apart from this, the gear patterns were excellent with contact patterns extending across the pinion face as shown in Figure 44. The tail takeoff bevels were also excellent, showing patterns very similar to those shown on tapes of the master gears. The combining spur gears and roller gear patterns were hardly visible. Evidence could be seen of very slight sliding on either side of the pitch line.

On the basis of these inspections, authorization to manufacture the gears for the third and fourth gearboxes and all spares was given.

Compliant Bearings

During the gear pattern development test runs, extremely high temperatures were recorded under high load conditions in the test gearbox at the second-row pinion bearings. This gearbox was assembled with compliant bearings, an advanced state-of-the-art bearing involving modifications to a cylindrical roller wherein both ends of the roller are recessed as shown in Figure 45. These hollow ended rollers were developed with the objective of increasing the range of misalignment which a cylindrical roller bearing could endure. Redistribution of the load due to misalignment is achieved by elastic deformation of the roller ends which produces a contact area without end effects (i.e., high stresses). These bearings were designed for this application to accommodate a slope of 0.0018 inch/inch at a load of 10,950 pounds.

The temperature of these bearings, which approached 150° C after a few minutes of operation at 3000 hp, never stabilized and limited high power test runs to 3 to 4 minutes duration. In contrast, the dummy gearbox second-row pinion spherical bearings operated at 85° C. Inspection revealed that the compliant bearings experienced overheating due to interference of the roller end faces with the inner and outer race bearing shoulders. The shoulder of the inner race and the inside face of the spacer, Figure 46, were heavily scored and discolored from contact with the end faces of the rollers. The reaction torque on the second-row pinion posts is 76,000 ft/lb when transmitting 3000 hp. This resolves to a tangential load on each cantilevered post of 10,950 pounds. The forces on the second-row gear meshes induce it to remain parallel; therefore, any slope of the pinion post has to be accommodated by the bearing. Detailed inspection of the bearings revealed 0.003 inch axial play with the rollers and outer race and 0.002 inch

Figure 44. Dynamic Gear Pattern - Input Bevel Pinion.

with the rollers and inner race. This was insufficient axial clearance to accommodate the slope of 0.0018 inch/inch induced on the shaft when transmitting full torque. Since the bearing could not absorb all the slope induced on the shaft, some was reacted by the gear. Inspection of the second-row gear assemblies revealed a slight burr on the top roller caused by the canted second-row assembly being reacted on the first-row pinion roller shoulder. This resulted in slight burrs on the first-row pinion shoulders. These and the second-row pinions were reworked to remove the burrs.

The compliant bearings of the dummy gearbox discussed above were replaced by spherical roller bearings. Also at this time, the main drive electric motors for the S-61 test facility were removed and rewound to increase their individual capacities from 150 hp to 225 hp. This requirement was to prevent motor overheating when running the roller gear transmissions. If the motors were not rewound, it would have necessitated operating in an overload condition. The overload condition would have generated excessive heat in the windings and possibly induced a breakdown in the wire insulation.

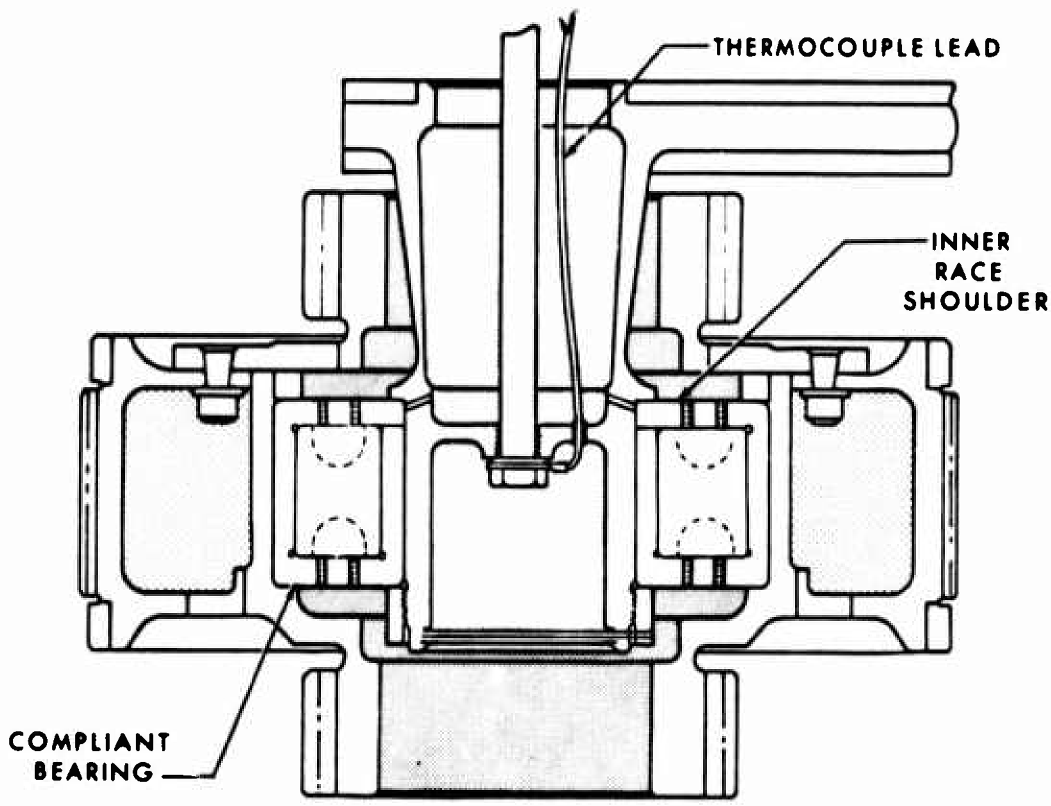
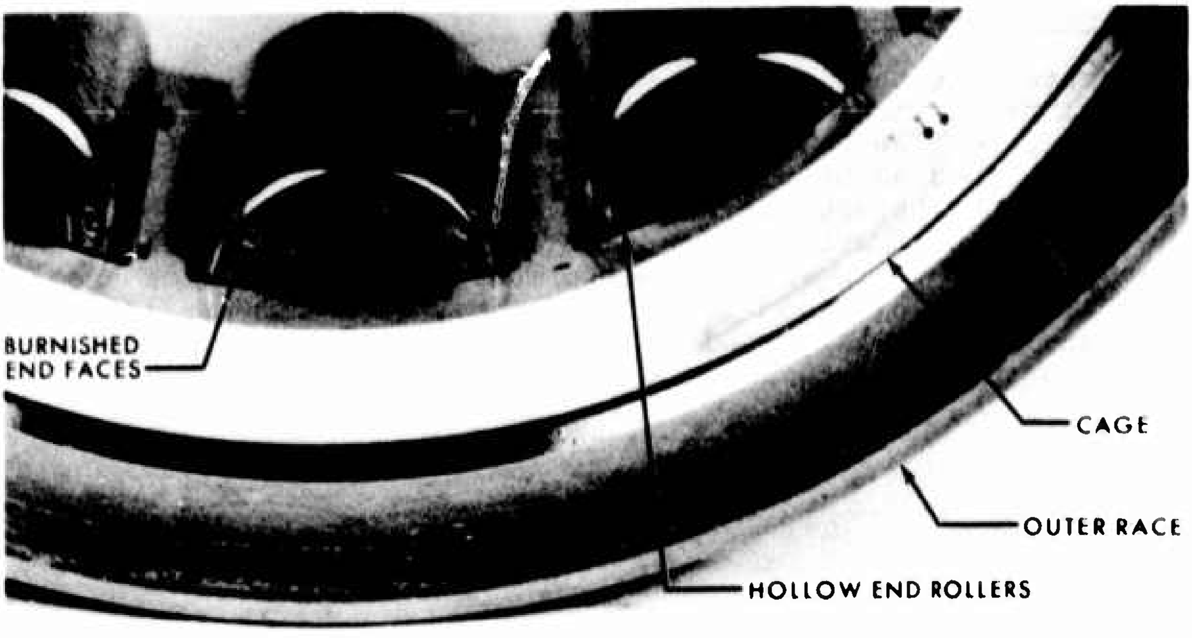


Figure 45. Compliant Bearing Installation - Second-Row Pinion Post.



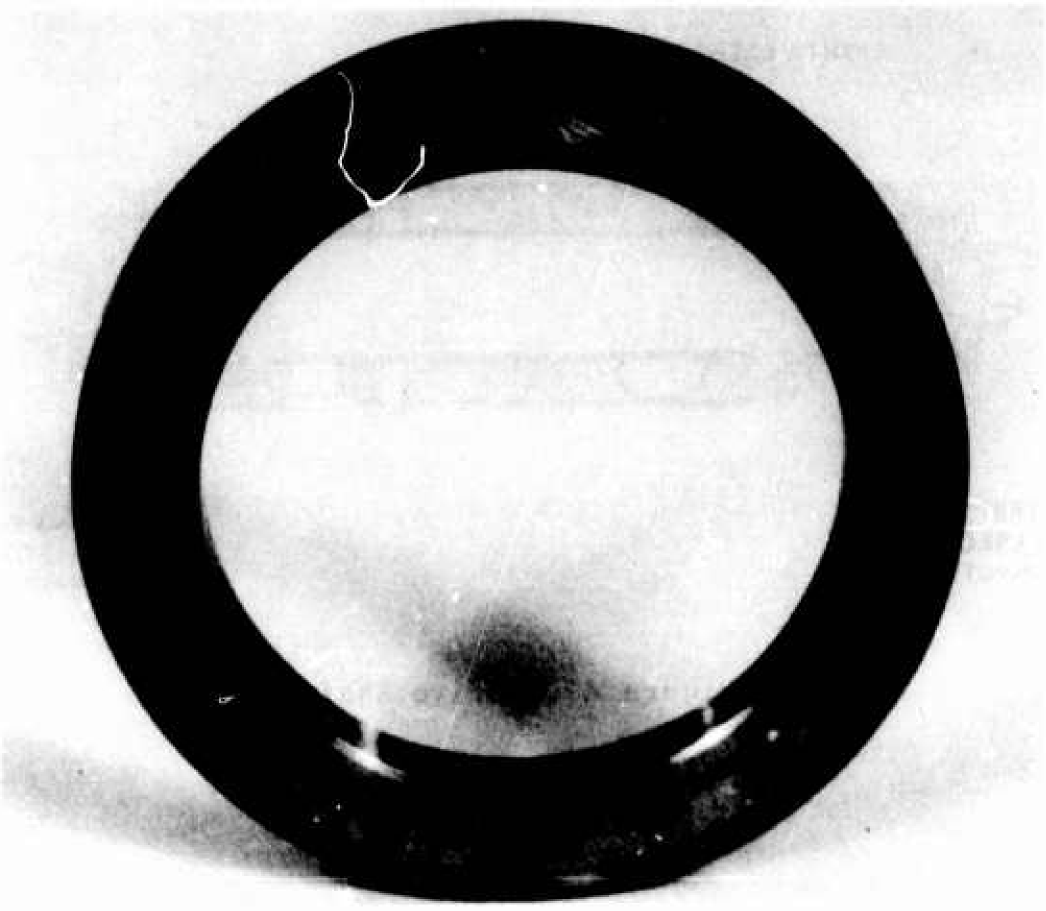


Figure 46. Compliant Bearing Damage.

INITIAL DEVELOPMENT TESTS

Preparatory to the 200-hour endurance tests, a series of initial development tests were conducted. In these test runs powers up to 3700 hp total input were imposed on the transmission with 3000 hp being transmitted through the roller gear drive and the balance through the tail rotor takeoff section. The purpose of these tests was to evaluate the S-61 roller gear transmission, to assess its performance characteristics under high loads for extended periods of time, to determine if there were any fundamental problems with the roller gear concept, and to evaluate manufacturing and assembly procedures.

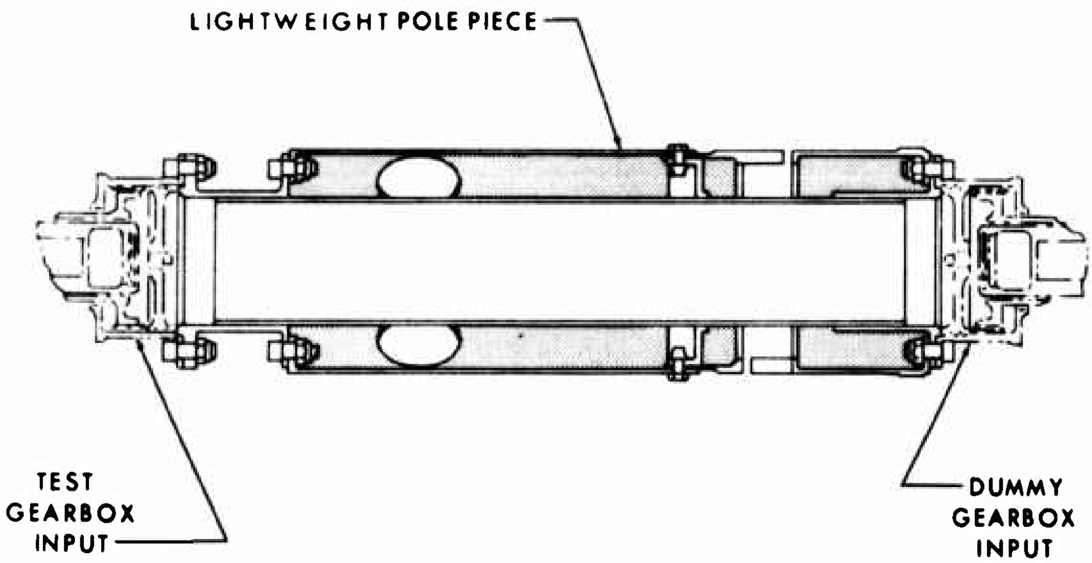


Figure 47. Drive Shaft.

Both test and dummy gearboxes were reinstalled in the regenerative test stand with a new input shaft assembly, Figure 47. This shaft was fabricated with lighter weight pole pieces than were used on the shaft for the gear pattern development test. The lighter pole pieces were designed to raise the critical speed of the shaft sufficiently to permit operation at 100 percent speed. A natural frequency test, similar to the one described for the gear pattern development test, indicated a natural frequency at 110 percent operating speed. Recognizing that with the limitations of this type of test a critical speed problem could be encountered, it was nevertheless decided to begin the initial testing with this shaft because of the desirability of having a dynamic torque measuring system.

The first segment of testing began at 3:42 total test time. Upon completing a warm-up period at 50 percent speed, facility speed was accelerated toward 100 percent speed. At approximately 95 percent speed, the long input shaft pole piece made contact with the protective shaft guard in the facility, and the test stand was immediately shut down (4:17 test hours).

The subsequent inspection revealed damage to the input shaft pole pieces and damage to the dummy gearbox input extension. Removal of the dummy left-hand input chip detector revealed numerous metallic particles, Figure 48. The input shafts and the dummy gearbox inputs were then removed for detail inspection. Teardown inspection of the left-hand dummy input revealed a complete breakdown of the ball bearing with extension housing, Figure 49. Severe spalling of the raceways had occurred from the high inertia loads of the whirling shaft. The balls had started to melt from the heat caused by the spalling of the raceways. Inspection of the left-hand input bevel pinion stack bearing assembly revealed an uneven wear path in the preload bearing of the four ball bearing stack caused by a raised nick on the split inner race. In addition, debris had passed through the preload bearing and scored the balls. This bearing assembly was deemed unusable and replaced. The input bevel pinion roller bearing was inspected, found satisfactory, and reinstalled. The carbon graphite face seal was damaged as was the crowned spline coupling shaft where the O-ring had scored the chrome plate O-ring seat, Figure 50. The seal and spline coupling were also replaced. Inspection of the right-hand dummy extension and input section showed minor damage to the stack bearings, roller bearing, and extension housing ball bearing. These bearings were replaced. The carbon seal and coupling were also damaged, resulting in their replacement.

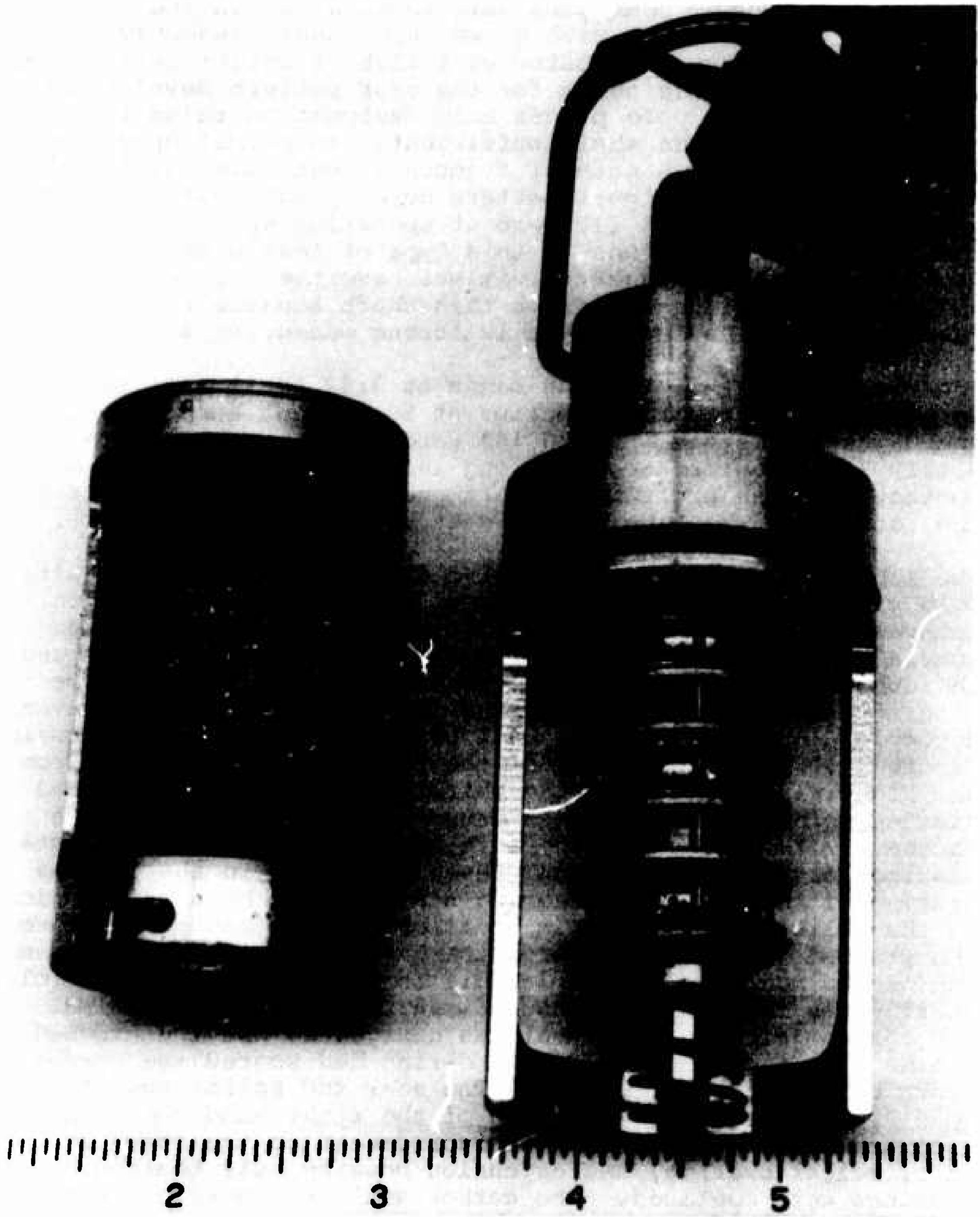


Figure 48. Chip Detector - Dummy Gearbox.

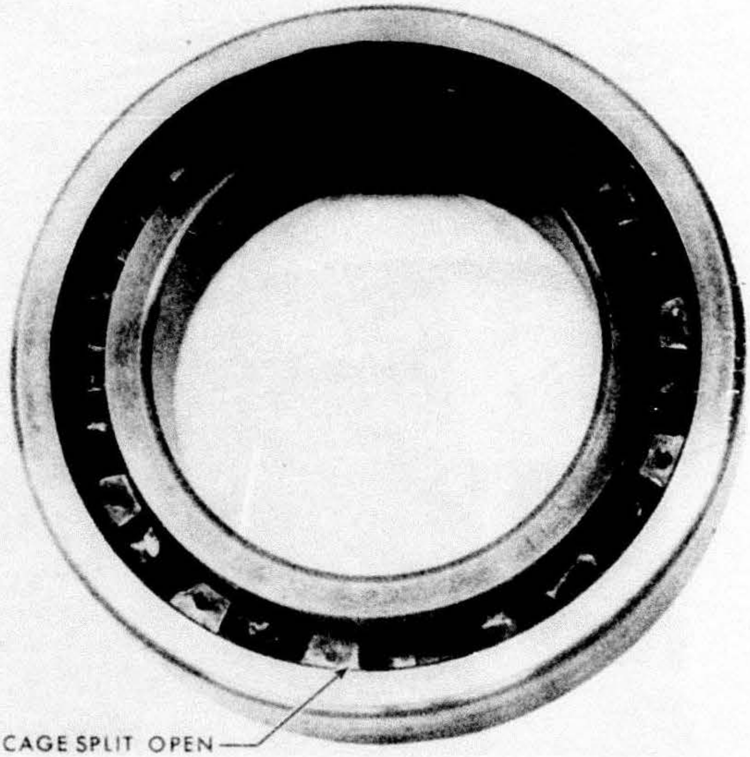


Figure 49. Ball Bearing - Dummy Gearbox Input.

Inspection showed that the test gearbox inputs were in good condition; however, the grease in the right-hand coupling had discolored. This coupling was repacked and reassembled. The left-hand coupling was in satisfactory condition.

Prior to reinstallation of the dummy gearbox input bevel pinion assemblies, blank covers were installed as seals over the dummy input bores, and the test stand was operated with no load at 50 percent and 100 percent speed to check out the gearboxes. The dummy inputs were then reinstalled. The input drive shafts were modified by removing the pole pieces, thereby reverting to the shaft configuration of Figure 43. The right-hand input shaft was strain gaged and calibrated.

The test stand with only the left-hand drive shaft installed was run for one hour at 1850 hp. This drive shaft was then removed to be strain gaged and calibrated. The right-hand drive shaft, which had been strain gaged and calibrated, was then installed and the test stand operated with only this drive shaft for one hour at 1850 hp. Testing was continued at 6:17 hours total test time with both shafts installed. Testing was halted at 17:28 total test time for a facility problem in the main rotor shaft coupling.

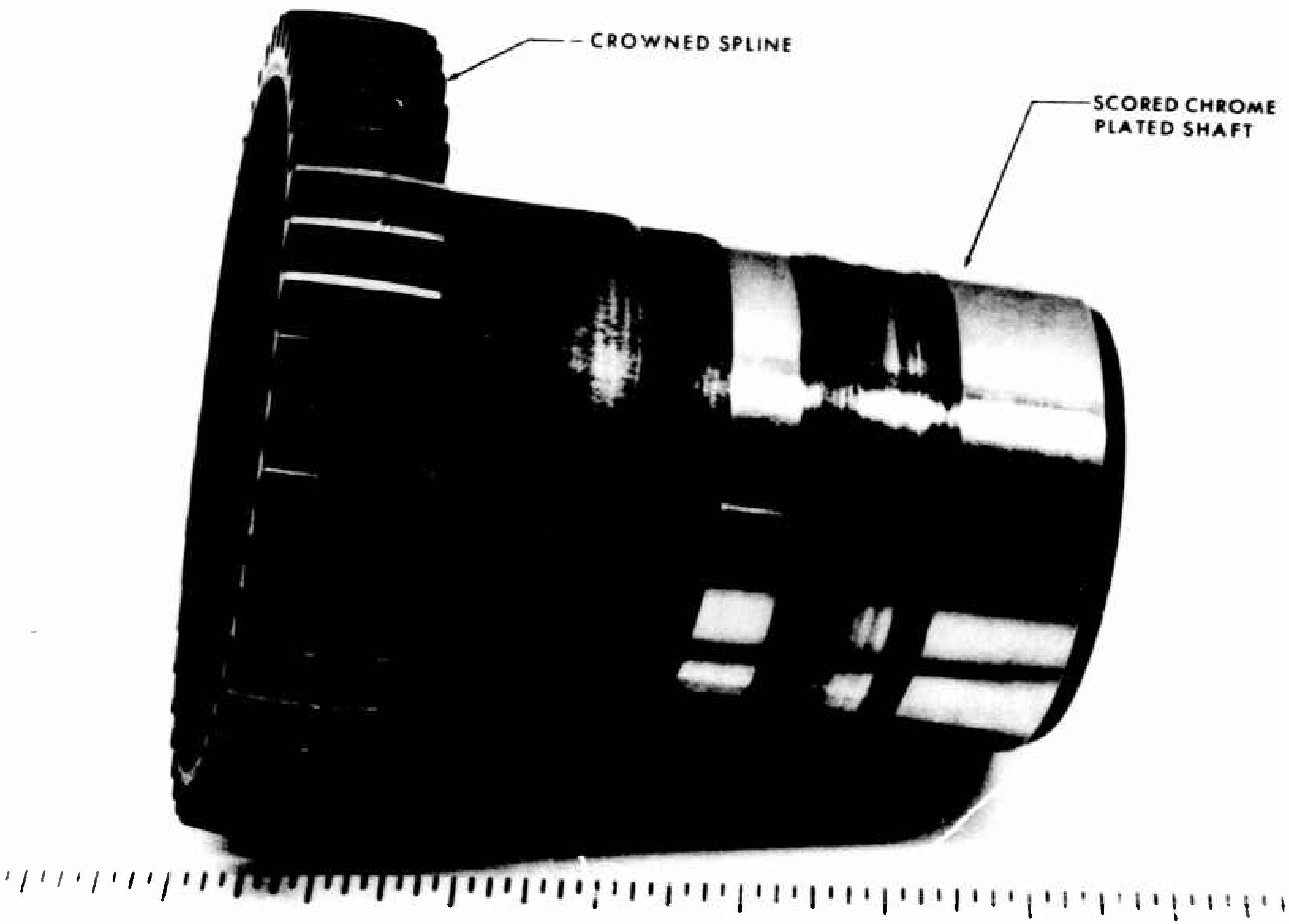


Figure 50. Splined Shaft - Input Coupling.

At this time both test and dummy gearboxes were partially disassembled. The roller gear units were removed from their respective gearboxes, disassembled and inspected. The roller gears from both gearboxes showed excellent gear tooth patterns on the sun/first row pinion and second row pinion/ring gear meshes. The first/second row gear pattern mesh was barely discernible. Visible on the shoulder of the first/second row lower rollers were signs of scuffing. Figure 51 shows gear serial number 12 which is the worse case. Lubrication to this area by gravity from the residue of the first/second row gear mesh was apparently insufficient. In order to ensure adequate lubrication to the first/second row lower rollers, orifices were drilled into the seven probe jets which directed oil onto the input side of the sliding contact surfaces of the rollers.

Figure 51. Scuffed Roller Shoulder - First-Row Pinion.

Upon completion of the above modification, testing was continued. At 18:28 total test time, the chip detector of the dummy gearbox roller gear unit was activated, and the test stand was immediately shut down. Inspection revealed that activation of the chip detector had been caused by an oil sealing washer which had come loose because of incorrect installation. No gearbox damage was sustained and a new washer was installed. While the gearbox was partially disassembled, it was noted that the main rotor thrust bearing was burred and had a debris pit in the outer race. This necessitated its replacement.

The gearbox was reassembled and installed in the test stand. Testing was continued at 18:28 test time.

At a total test time of 26:28 hours, chips were found in the forward sump chip detector of the test gearbox, Figure 52. Because of the compartmentalization of the gearbox, the chips could have originated only from the roller gear unit. The test and dummy gearboxes were removed from the test stand for disassembly and inspection.

Visual Inspection

Visual inspection of the test gearbox first-row pinions revealed spalling of the small roller diameters of pinion serial number 05 located as shown in Figure 53. This pinion shows a spalled area approximately 2.5 inches in length around the lower roller in Figure 54. Spalling of the top roller was less severe, extending for approximately 0.5 inch, Figure 55. Visual inspection of the remaining first-row pinions revealed some evidence of edge loading but no surface breakdown. The roller surfaces of the second-row pinions showed no wear. The sun gear rollers, although showing slight pitting due to debris, displayed no signs of fatigue damage. Inspection of the dummy transmission first-row pinions indicated burnishing of several small roller diameters, Figure 56. Magnetic particle inspection of all roller gear components from the test and dummy gearboxes did not reveal any surface orientated cracks.

Dimensional Inspection

A dimensional inspection of the sun, first-row pinions and second-row pinions indicated all critical dimensions including gear spacing and timing, roller diameters, and concentricity to be within the required drawing dimensions. Figures 57 and 58 show the inspection equipment used for measuring the 'X' dimensions between the master index teeth on the outer and inner gears of the first-row pinions.

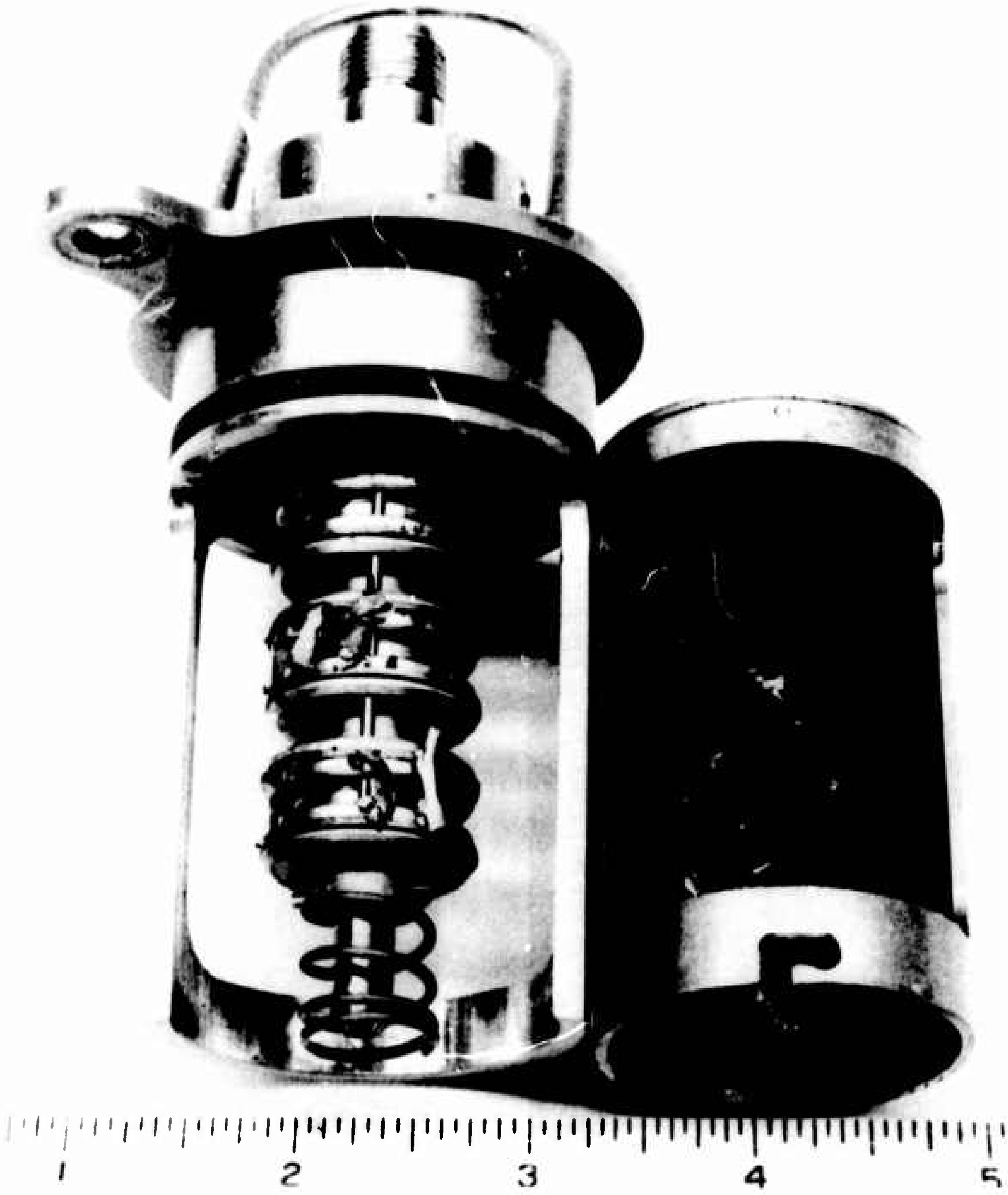


Figure 52. Chip Detector - Test Gearbox.

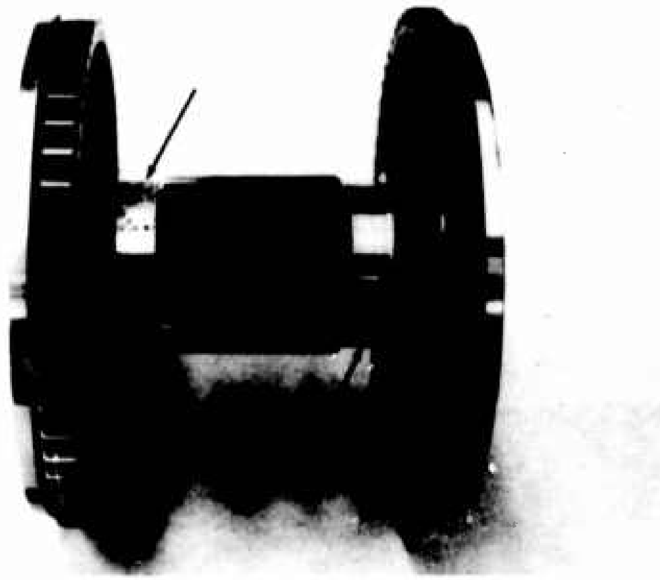


Figure 53. Spalled Rollers - First-Row Pinion Test Gearbox.

Figure 54. Spalled Lower Roller.

Figure 55. Spalled Top Roller.

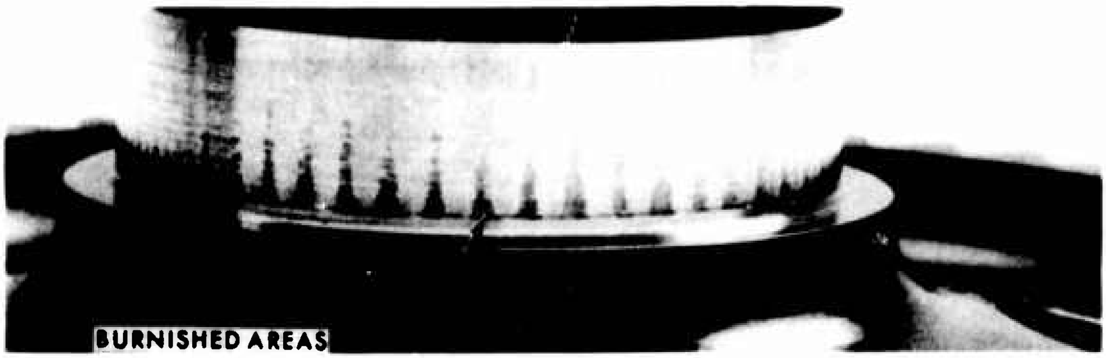


Figure 56. Burnished Roller - First-Row Pinion Dummy Gearbox.

Metallurgical Inspection, First-Row Pinion Roller Weld Fracture

Microscopic examination of first-row pinion serial number 05 revealed that spalling of the lower roller was caused by fatigue cracking originating below the surface and propagating to the surface. A cross-sectional sample, Figure 59, taken in an unspalled area immediately adjacent to the spalling revealed a subsurface crack extending through the electron beam weld zone as shown in Figure 60. There was no evidence of this crack at the surface. Metallographic examination revealed a series of voids along the weld line as shown in Figure 61. Cracks were evident extending from one of these voids, as indicated by the arrow in Figure 61 and shown in Figure 62. Examination revealed a desired case microstructure of martensite and tempered austenite with no evidence of carbide network.

Microscopic examination of the spalling on the roller from the top side of the assembly revealed fatigue cracking of the surface with no evidence of subsurface origins. A metallurgical specimen taken adjacent to the spalling did not exhibit subsurface cracking in this area. Voids in the weld zone, similar to those evident in the weld in the opposite roller, were evident. Spalling of this surface may have been a result of load transfer occurring from a loss of contact area when the lower roller spalled.

A microhardness traverse through the case-hardened surface of the small diameter rollers, in a direction normal to the surface, showed a slight reduction in hardness and effective case depth on both top and lower rollers. This plot is shown in Figure 63. This reduction is explained by the removal of stock during the final roller grinding operation and is probably the result of high temperatures generated during electron beam welding. The microhardness survey reveals a smooth transition from case to core with effective case depth measured at R_C 50. The low case hardness and depth were not considered factors in the spalling, since the cracking originated subsurface at voids in the weld.

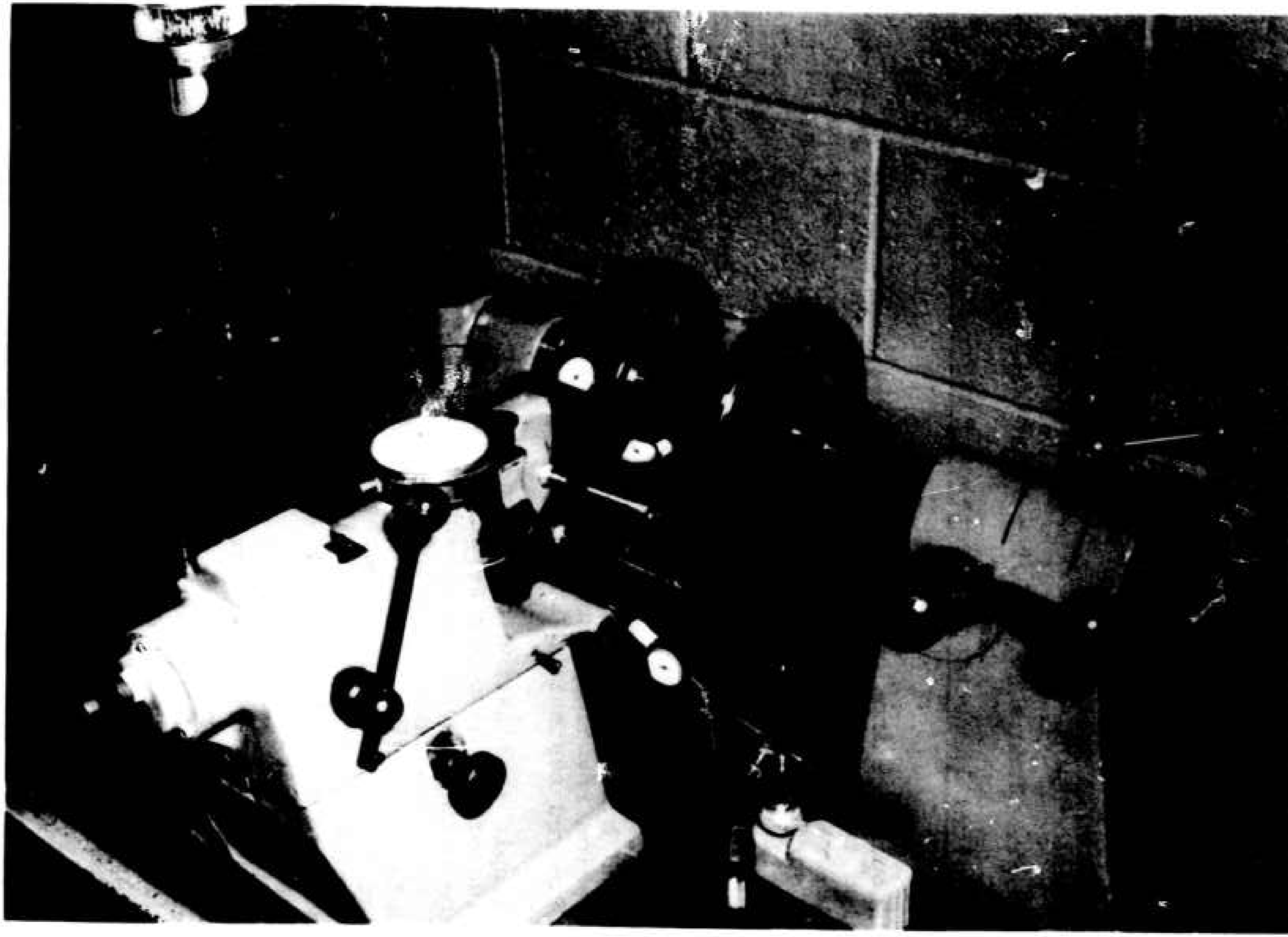


Figure 57. Inspection - First-Row Pinion Small Gear.

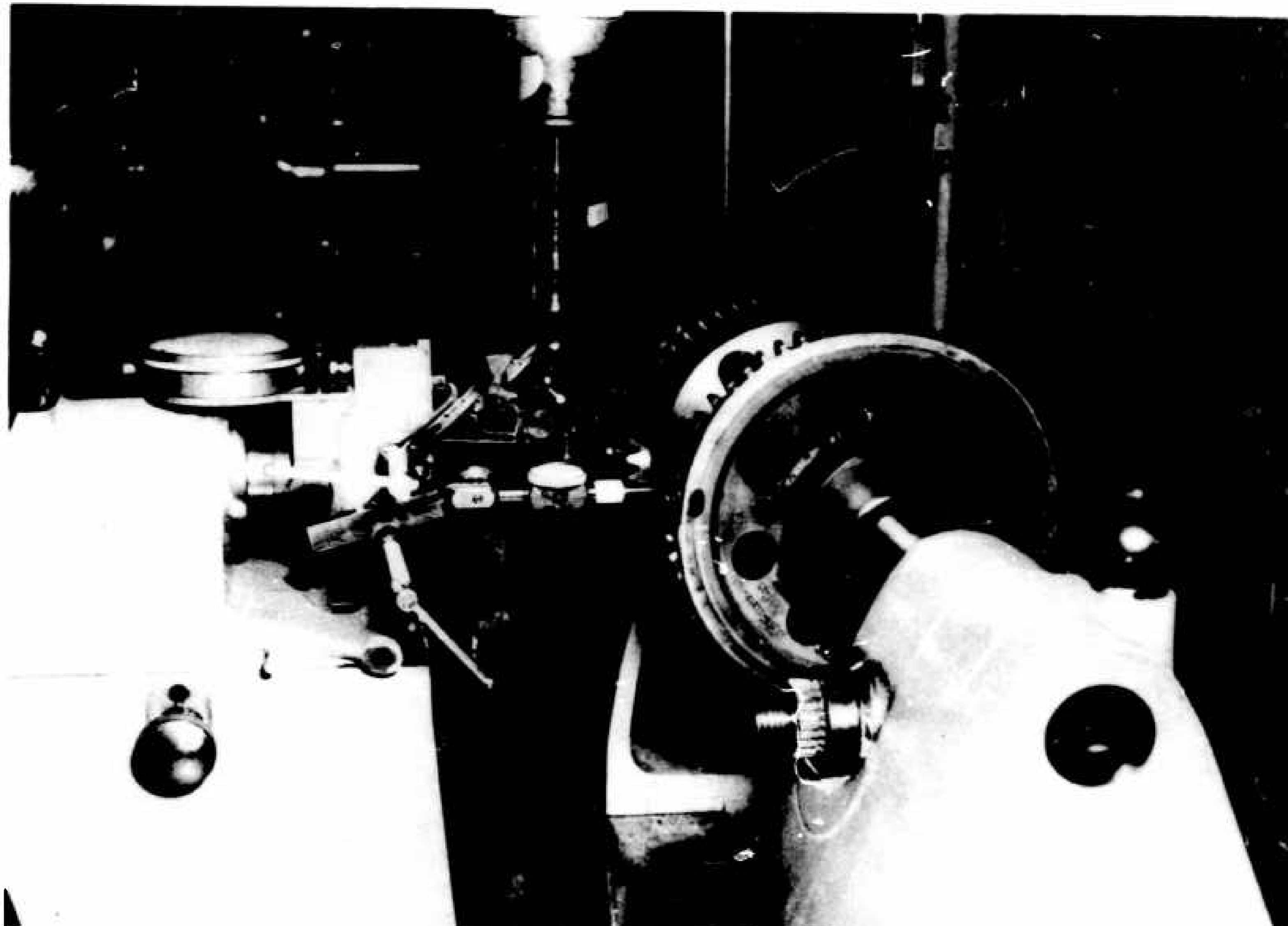


Figure 58. Inspection - First-Row Pinion Large Gear.

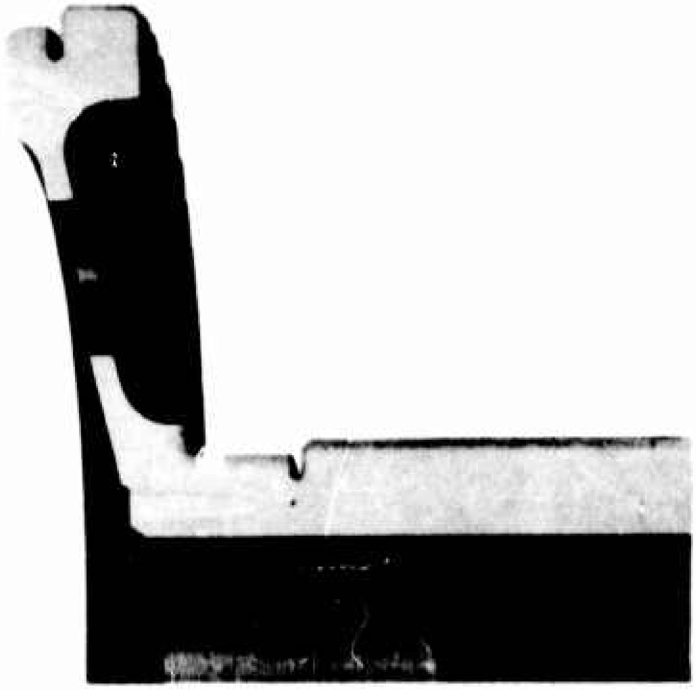


Figure 59. Sectional View - First-Row Pinion.

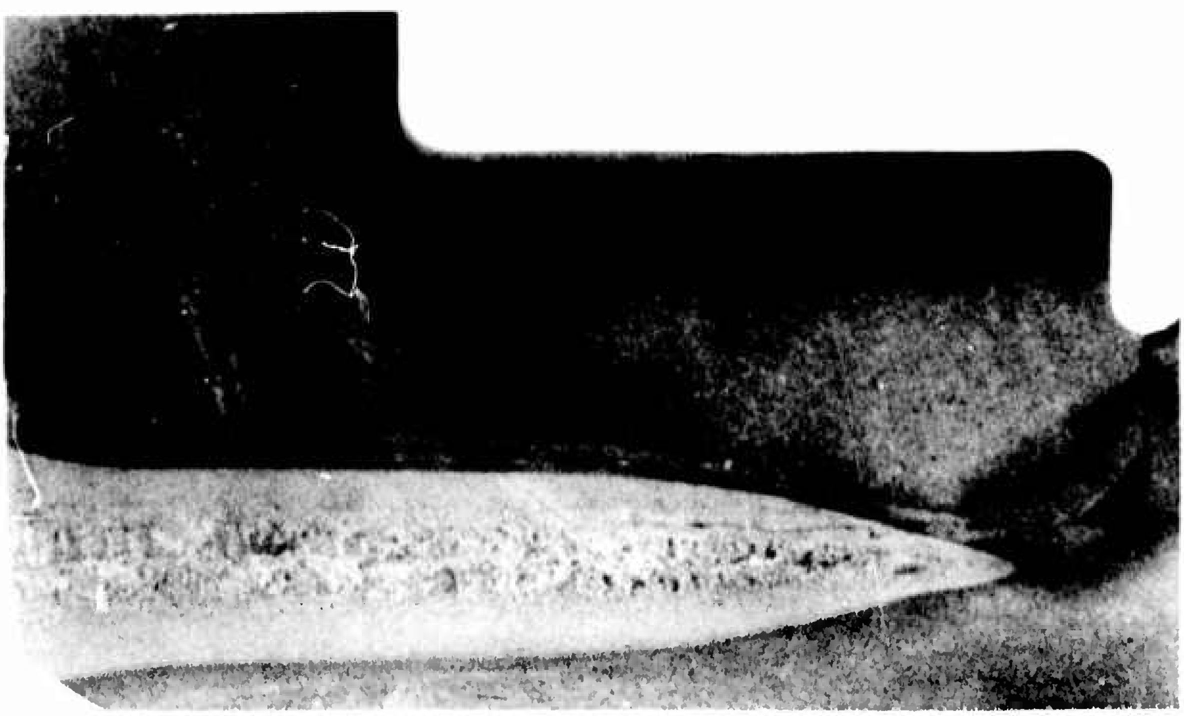


Figure 60. Electron Beam Weld - First-Row Pinion.

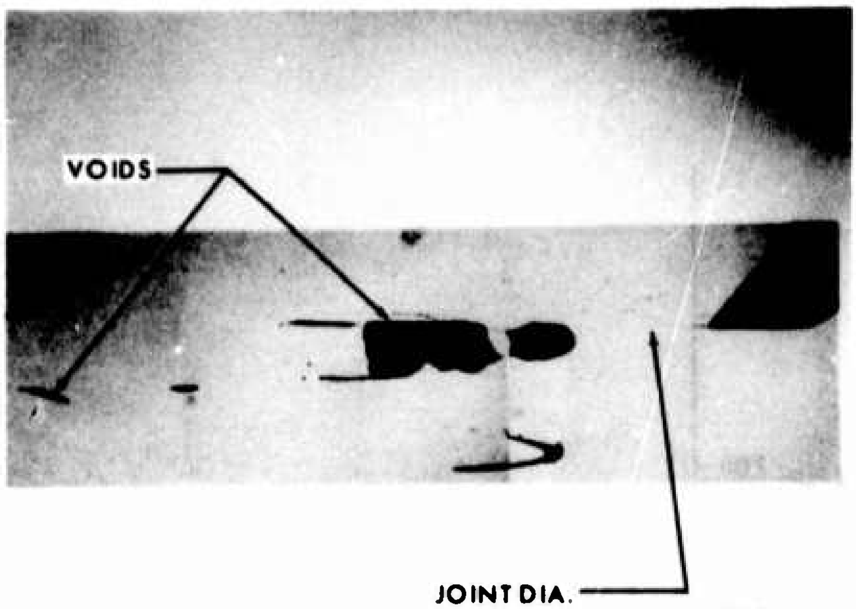


Figure 61. Voids - Electron Beam Weld.

Figure 62. Cracks Extending From Electron Beam Weld Voids.

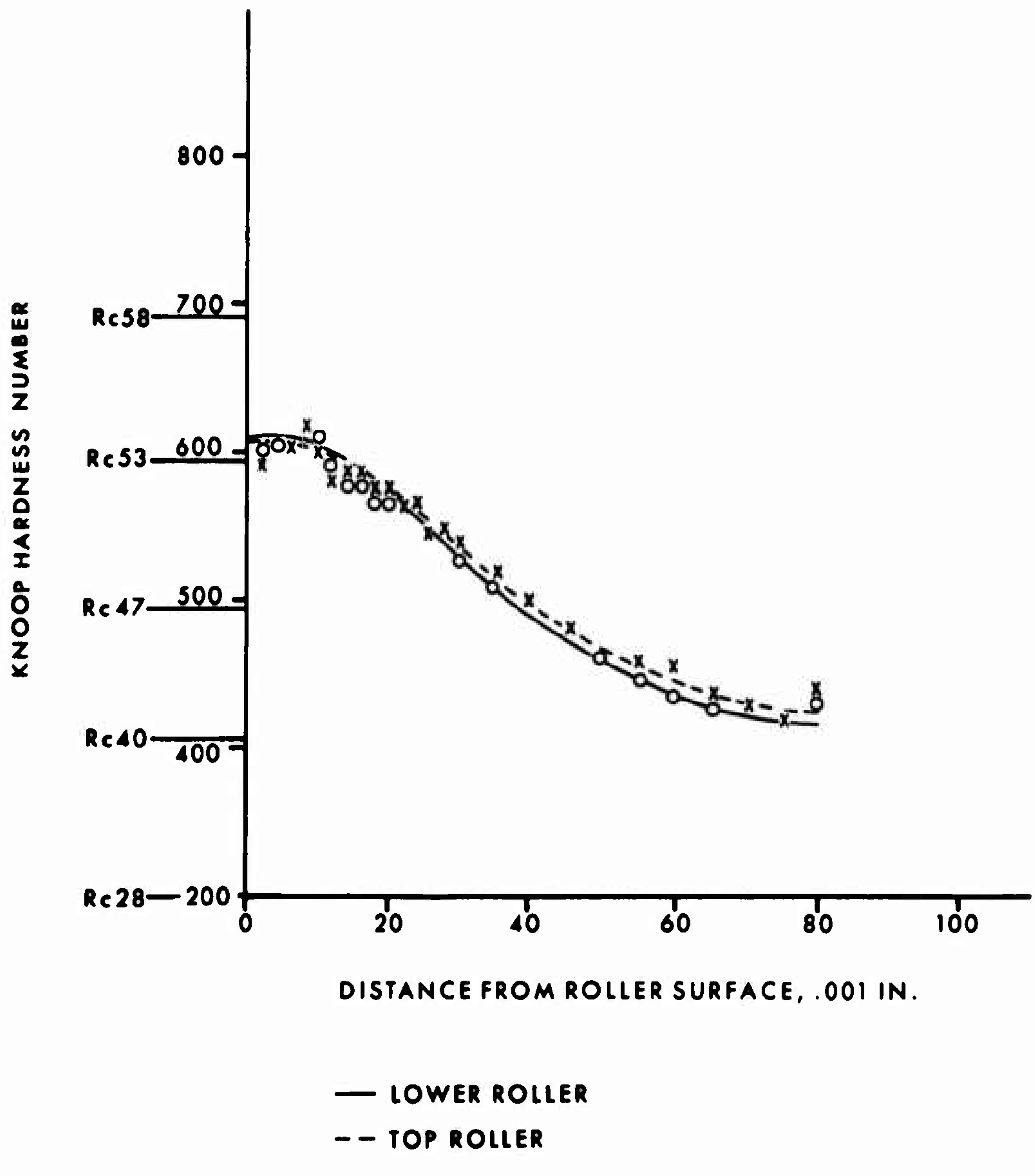


Figure 63. Roller Microhardness Versus Depth - First-Row Pinion.

It was concluded that the fracture initiated in the area of the electron beam weld. Subsurface stresses produced by roller contact forces caused cracking in areas of porosity of the electron beam weld. The weld porosity was most likely caused by the depth of the weld and the speed at which the part had to be welded in order to avoid affecting the hardness of the roller contact surfaces.

Ultrasonic Inspection, First-Row Pinion

Ultrasonic testing was conducted on the small diameter rollers of the first-row pinions to determine if detection of subsurface cracking was possible. A direct contact Krautkramer ultrasonic flaw detector was used in conjunction with a dual transducer utilizing longitudinal waves. Acoustic contact between the transducer and the roller surface was by glycerine. A 0.25-inch-thick steel reference block was used for calibration of the ultrasonic equipment, this being representative of the distance from the roller surface to the weld. Gear assembly serial number 14 from the test gearbox exhibited a sonic indication of an abnormality. Laboratory sectioning through the groove between the small gear and adjacent roller revealed subsurface cracking extending for approximately half the circumference, as shown in Figure 64. A series of voids was apparent around the entire circumference, as shown in Figure 65. Separation of the crack interface revealed multiple fatigue zones originating at voids in the weld zone, shown typically in Figures 66 and 67. The cracking in this gear is similar to the cracking evident in gear assembly serial number 05.

First-Row Pinion Burnishing

It was concluded that the burnish markings which occurred only on the rollers in the dummy roller gear unit were the result of applying the lubricant into mesh. The probe jets were designed to lubricate the test gears and rollers out of mesh. Since the dummy transmission rotates in the opposite direction, lubrication for this box was applied into mesh, resulting in localized overheating.

On the basis of the findings, a two-phase course of action was decided upon. In the first phase, an ultrasonic inspection technique would be developed to ensure the integrity of the electron beam welds. The initial development test would continue with first-row pinions already manufactured provided they passed the ultrasonic inspection. The roller surface finish on all rollers would be improved. The second phase, to be incorporated should cracking occur in testing of these first-row pinions, would be a redesign of the first-row pinion assembly, which incorporates an electron beam butt welded joint as shown in Figure 68.

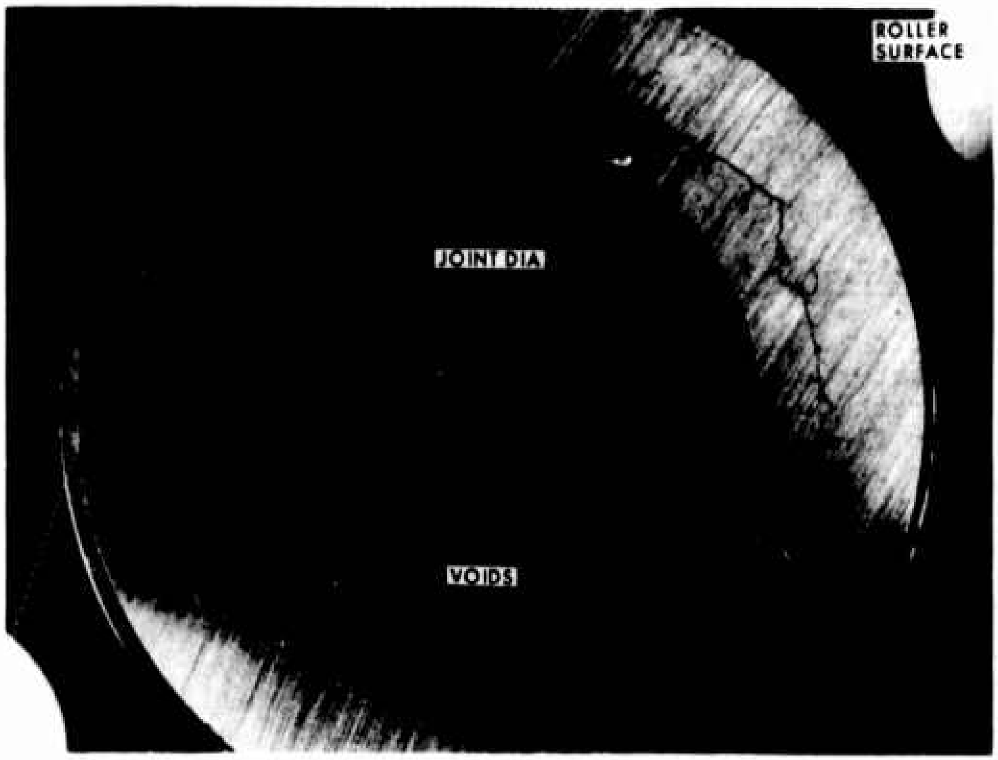


Figure 64. Circumferential Crack - Roller/Gear Interface.

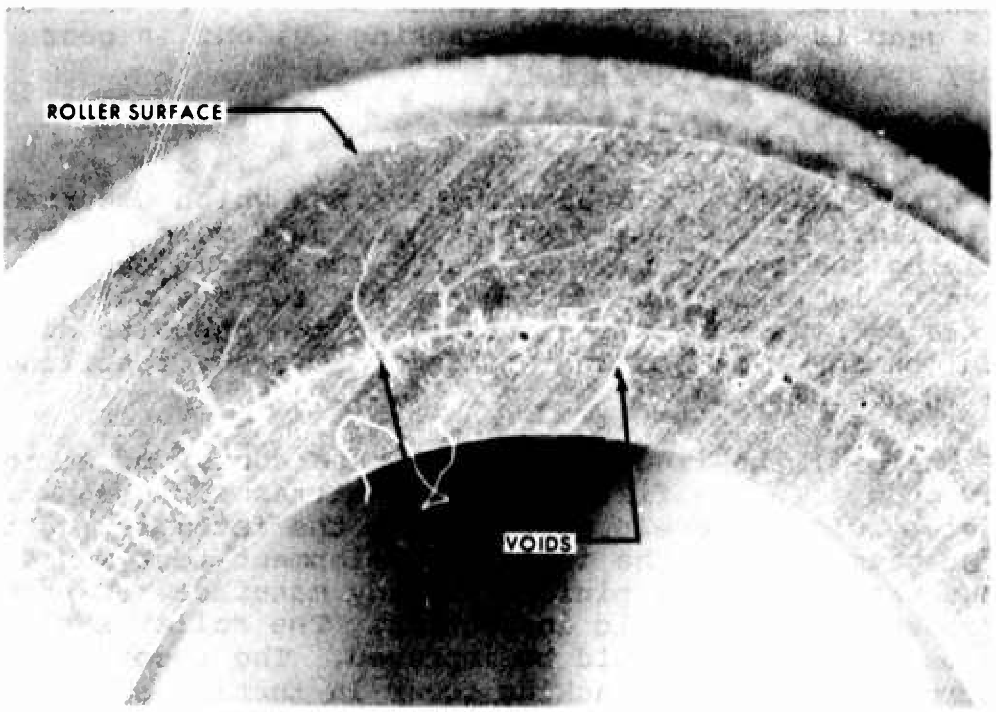


Figure 65. Circumferential Crack - First-Row Pinion.

Figure 66. Roller Separation - First-Row Pinion.

Figure 67. Voids - First-Row Pinion Roller.

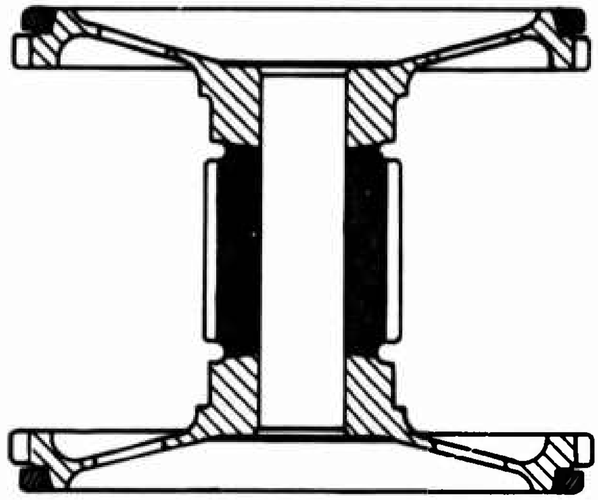


Figure 68. First-Row Pinion - Butt Weld Configuration.

Gearbox Modifications

Lubrication oil to the roller gear unit is supplied from the manifold via a cored line in the main housing to a reservoir in the outer shaft housing. Seven probe jets tap into this reservoir and direct oil to each roller/gear mesh. A restrictor aft of the manifold is used to regulate the amount of oil supplied to the roller gear unit. Figure 69 shows the oil path to the probe jet. At this time the size of the feed hole to the reservoir was increased from 0.18 to 0.37 inch diameter and the outer shaft housing was machined to increase the volume of the reservoir.

Inspection of the roller bearings on the input bevel pinions of the dummy gearbox revealed track marks in the outer race and glazing of the inner race, Figure 70, which necessitated their replacement.

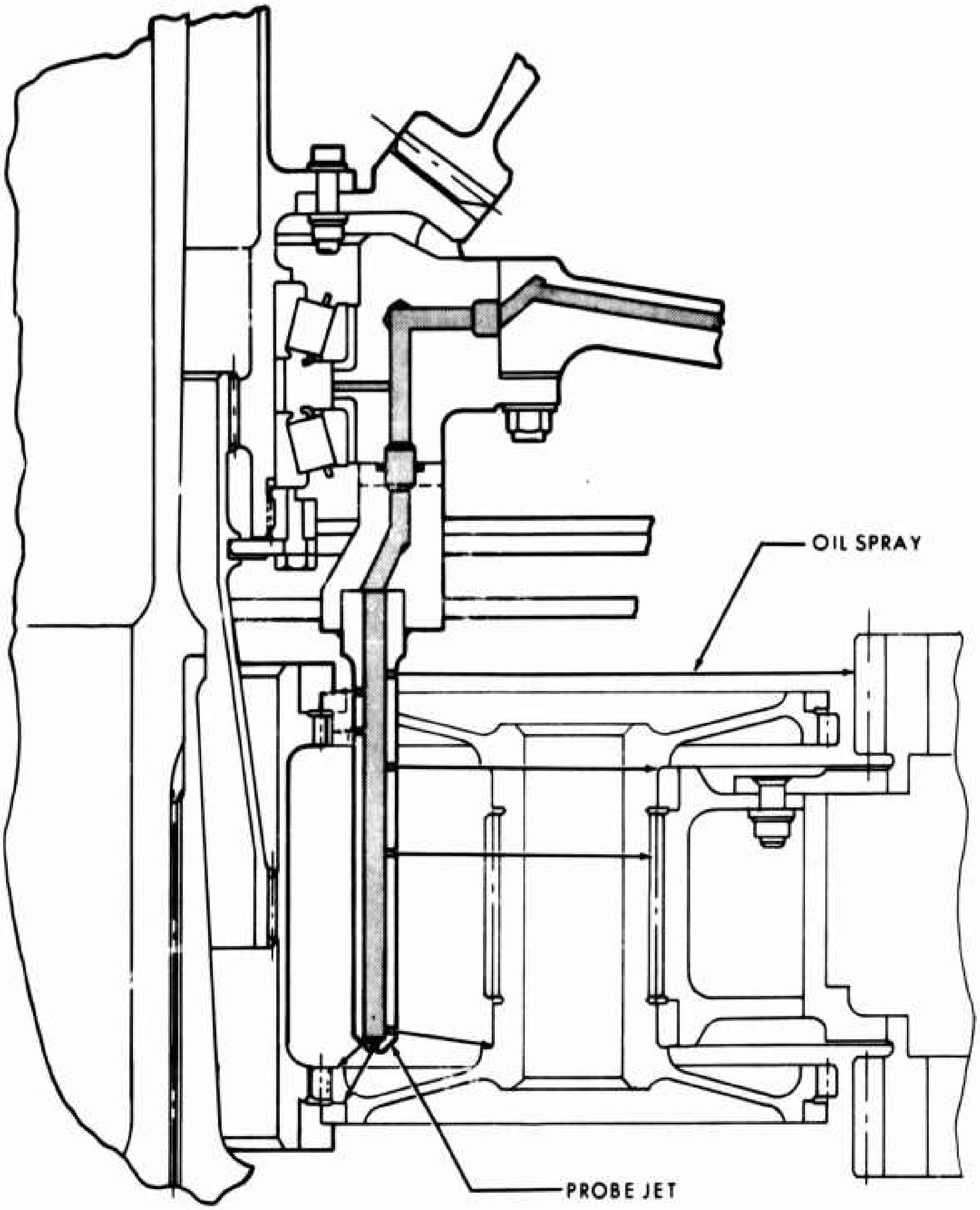


Figure 69. Probe Jet - Roller Gear Unit.

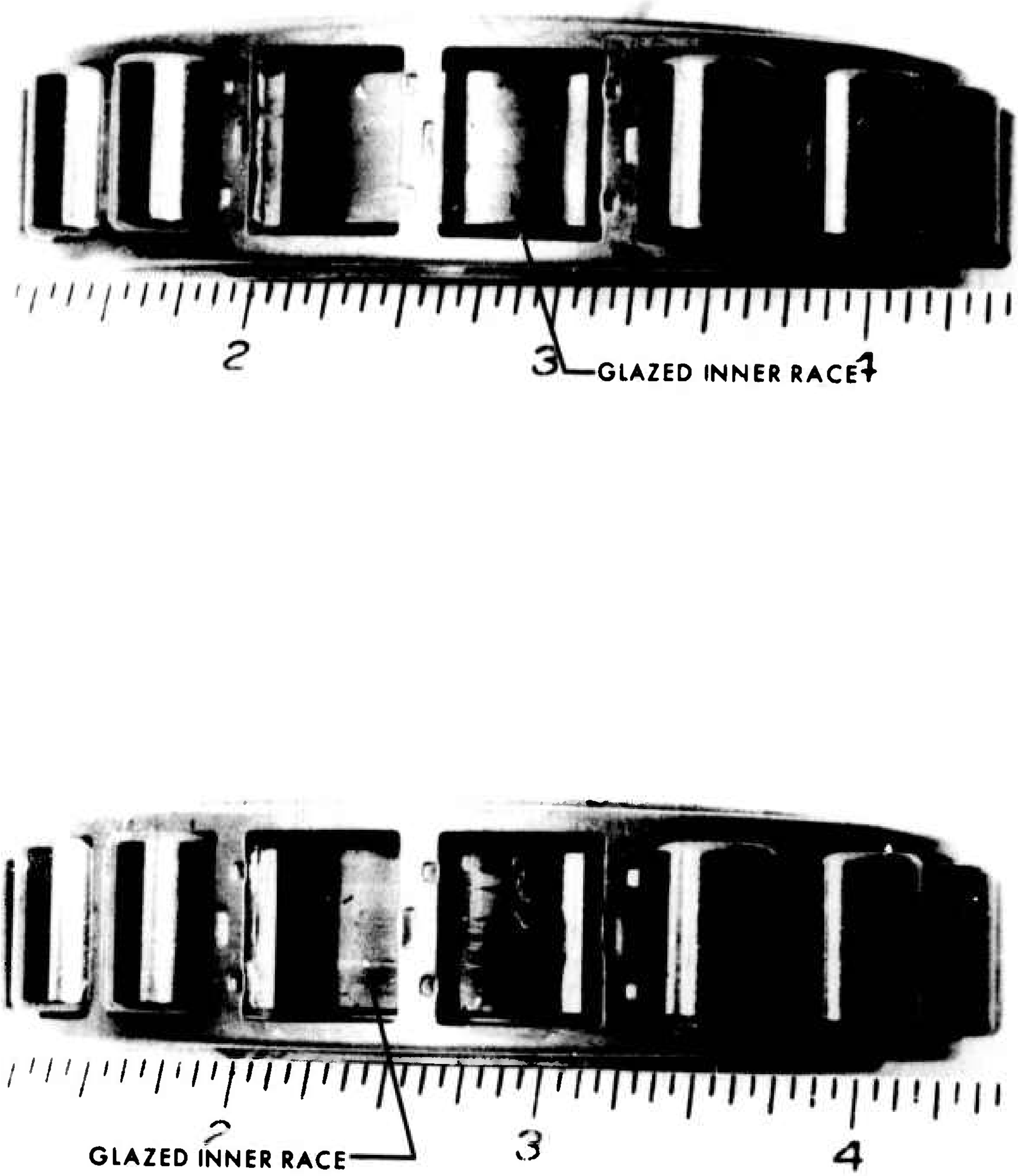


Figure 70. Roller Bearings - Input Bevel Pinions.

With the completion of the internal modifications to the transmission housings, and the assembly of both test and dummy roller gear units with new sun gears and first- and second-row pinions, as listed on Tables IX and X and located as shown in Figures 71 and 72, the gearboxes were reassembled and reinstalled in the test stand for continuation of the initial testing. A torque split at the inputs was obtained using strain gaged drive shafts. Testing was then continued for an additional 9.5 hours (total test time 35:58 hours), at which time testing was terminated when a large quantity of metallic particles were found on the dummy gearbox sump chip detector, as shown in Figure 73. Inspection of all other chip detectors in the test and dummy gearboxes showed them to be free of metallic particles. The gearboxes were removed from the test facility for teardown inspection. The power spectrum the gearboxes were subjected to during the 9.5 hours of testing is given in Appendix I. Review of the data sheets revealed no indication that a malfunction had or was occurring.

Removal of the dummy gearbox sump showed more chips similar to those in the chip detector. Removal of the roller gear drive and the disassembly of the output flange at the ring gear displayed the unit and parts located as shown in Figure 72. An assembly check using the timing marks on the first- and second-stage pinions revealed that all gears aligned correctly and the unit rotated freely. Further examination of the roller gear unit revealed separation of the second-row pinion, top, output ring gear meshing gear, serial number 32 at the 4.061-inch-diameter weld, Figure 74.

Visual Inspection

Inspection of the fractured second-row pinion revealed a machined surface approximately 0.090 inch wide and extending for approximately 50 percent of the circumference in the fractured area as indicated in Figure 75. This machined diameter is the electron beam weld joint face between the flange and the gear.

The remaining second-row pinions in the roller gear unit incurred damage on the large diameter gears from debris. Figure 76 is typical of the damage sustained by these gears. Figure 77 shows a similar type of damage sustained by the first-row pinions. The ring and sun gears from the dummy gearbox roller gear unit sustained slight superficial damage. It is interesting to note that the rolling surfaces on all pinions were in excellent condition.

TABLE IX. TEST #2 - ROLLER GEAR UNIT COMPONENTS - TEST GEARBOX

Part Number	Nomenclature	Serial Number	Status	Test Hours:Minutes
RG351-11183-041	Sun Gear	08	New	0
RG351-11182-042	1st-Row Pinion	19	New	0
RG351-11182-042	1st-Row Pinion	21	New	0
RG351-11182-042	1st-Row Pinion	23	New	0
RG351-11182-042	1st-Row Pinion	26	New	0
RG351-11182-042	1st-Row Pinion	27	New	0
RG351-11182-042	1st-Row Pinion	29	New	0
RG351-11182-042	1st-Row Pinion	30	New	0
RG351-11182-042	2nd-Row Pinion	12	New	0
RG351-11182-042	2nd-Row Pinion	25	New	0
RG351-11182-042	2nd-Row Pinion	27	New	0
RG351-11182-042	2nd-Row Pinion	34	New	0
RG351-11182-042	2nd-Row Pinion	36	New	0
RG351-11182-042	2nd-Row Pinion	40	New	0
RG351-11182-042	2nd-Row Pinion	41	New	0
RG351-11184-041	Ring Gear	02	Used in Test #1	26:30
22313 VAG	Spherical Bearing	N1	New	0
22313 VAG	Spherical Bearing	N5	New	0
22313 VAG	Spherical Bearing	N14	New	0
22313 VAG	Spherical Bearing	N28	New	0
22313 VAG	Spherical Bearing	N33	New	0
22313 VAG	Spherical Bearing	N34	New	0
22313 VAG	Spherical Bearing	N37	New	0

TABLE X. TEST #2 - ROLLER GEAR UNIT COMPONENTS - DUMMY GEARBOX

Part Number	Nomenclature	Serial Number	Status	Test Hours:Minutes
RG351-11183-041	Sun Gear	03	New	0
RG351-11182-042	1st-Row Pinion	18	New	0
RG351-11182-042	1st-Row Pinion	20	New	0
RG351-11182-042	1st-Row Pinion	22	New	0
RG351-11182-042	1st-Row Pinion	24	New	0
RG351-11182-042	1st-Row Pinion	25	New	0
RG351-11182-042	1st-Row Pinion	28	New	0
RG351-11182-042	1st-Row Pinion	31	New	0
RG351-11181-042	2nd-Row Pinion	28	New	0
RG351-11181-042	2nd-Row Pinion	32	New	0
RG351-11181-042	2nd-Row Pinion	33	New	0
RG351-11181-042	2nd-Row Pinion	39	New	0
RG351-11181-042	2nd-Row Pinion	42	New	0
RG351-11181-042	2nd-Row Pinion	43	New	0
RG351-11181-042	2nd-Row Pinion	47	New	0
RG351-11184-041	Ring Gear	04	Used in Test #1	26:30
22313 VAG	Spherical Bearing	N2	Used in Test #1	26:30
22313 VAG	Spherical Bearing	N10	Used in Test #1	26:30
22313 VAG	Spherical Bearing	N15	Used in Test #1	26:30
22313 VAG	Spherical Bearing	N25	Used in Test #1	26:30
22313 VAG	Spherical Bearing	N26	Used in Test #1	26:30
22313 VAG	Spherical Bearing	N31	Used in Test #1	26:30
22313 VAG	Spherical Bearing	N45	Used in Test #1	26:30

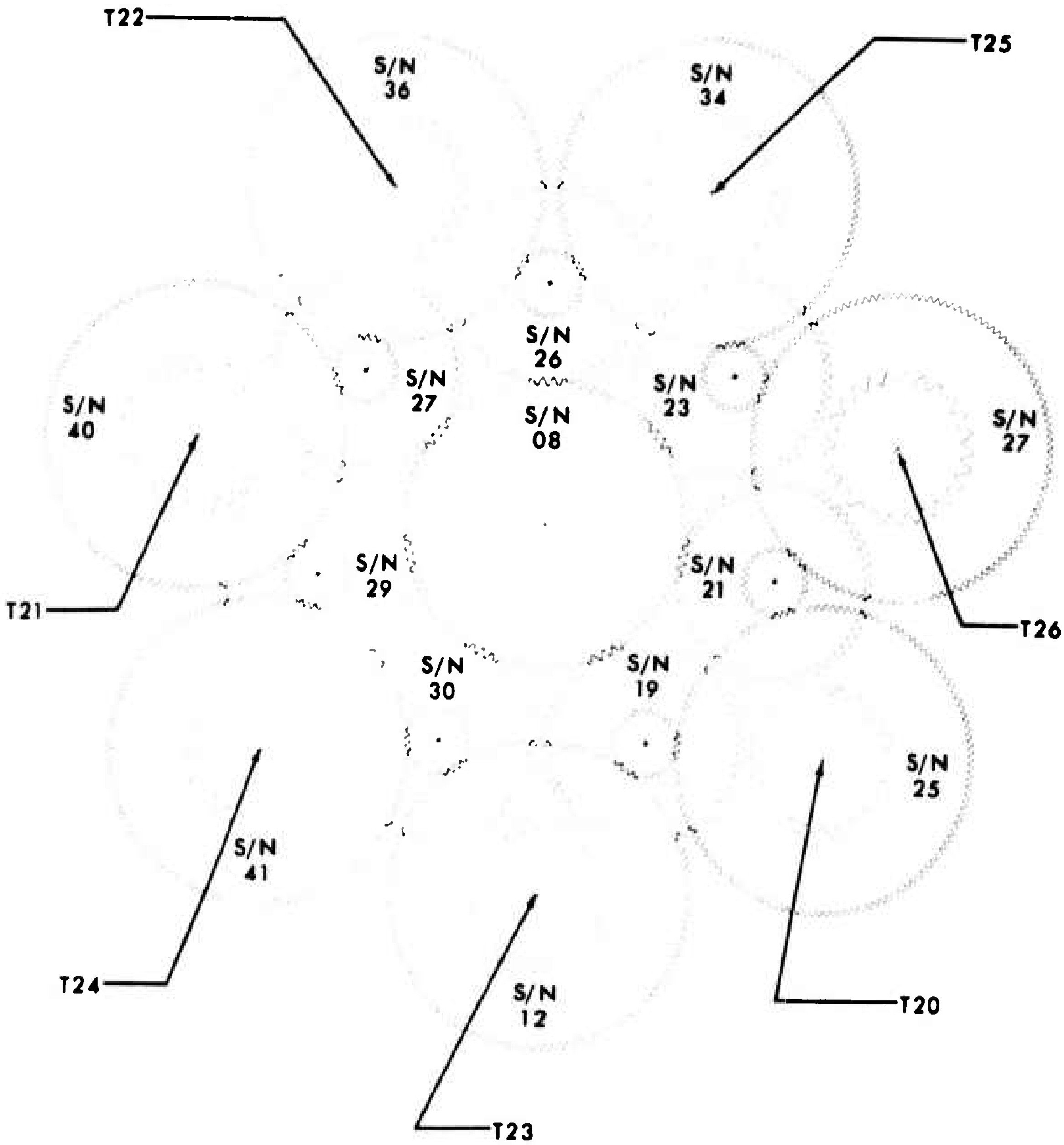


Figure 71. Component Location - Test Roller Gear Unit.

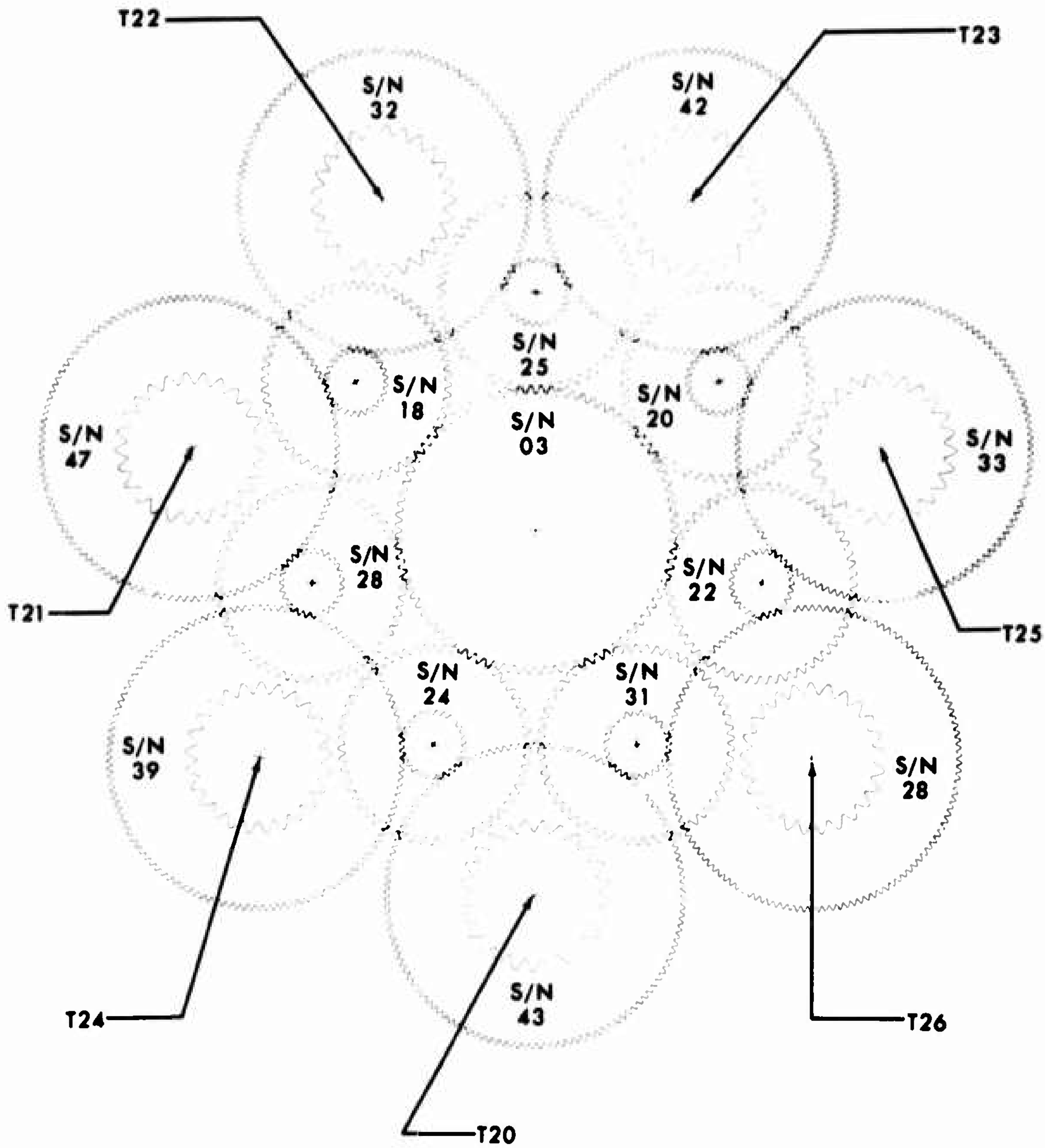


Figure 72. Component Location - Dummy Roller Gear Unit.

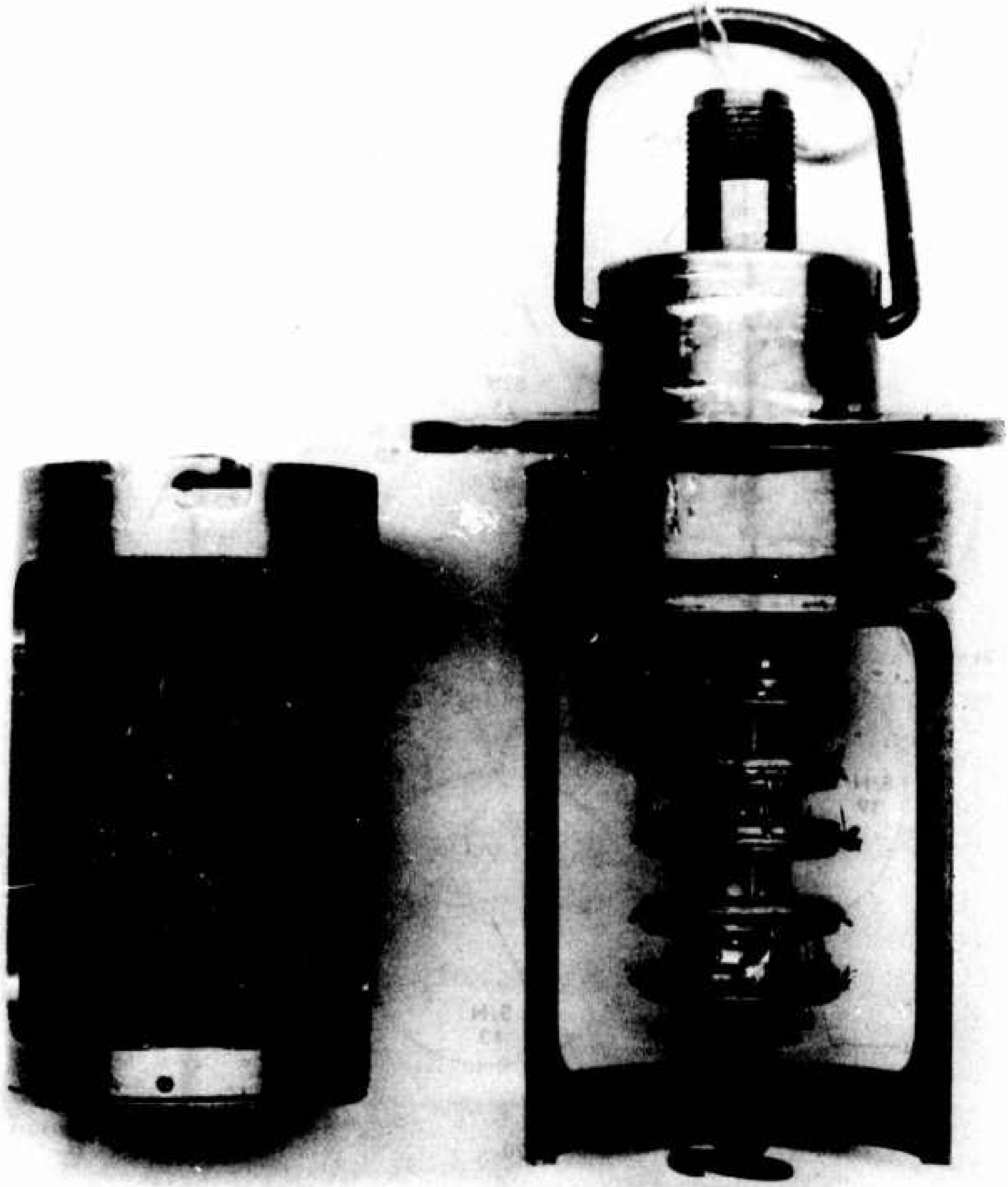


Figure 73. Chip Detector - Dummy Gearbox.

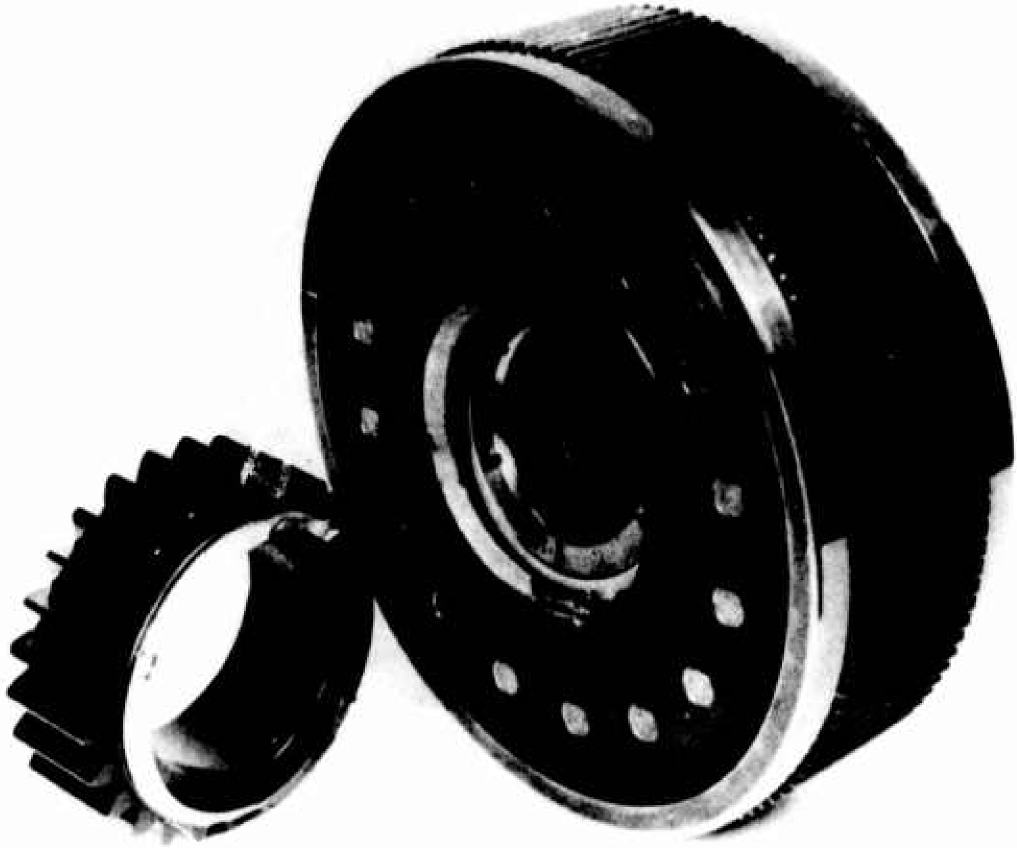


Figure 74. Gear Separation - Second-Row Pinion Dummy Gearbox.

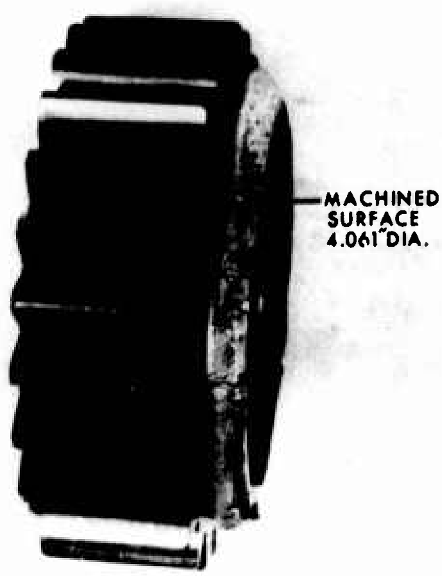


Figure 75. Separated Second-Row Pinion Gear.

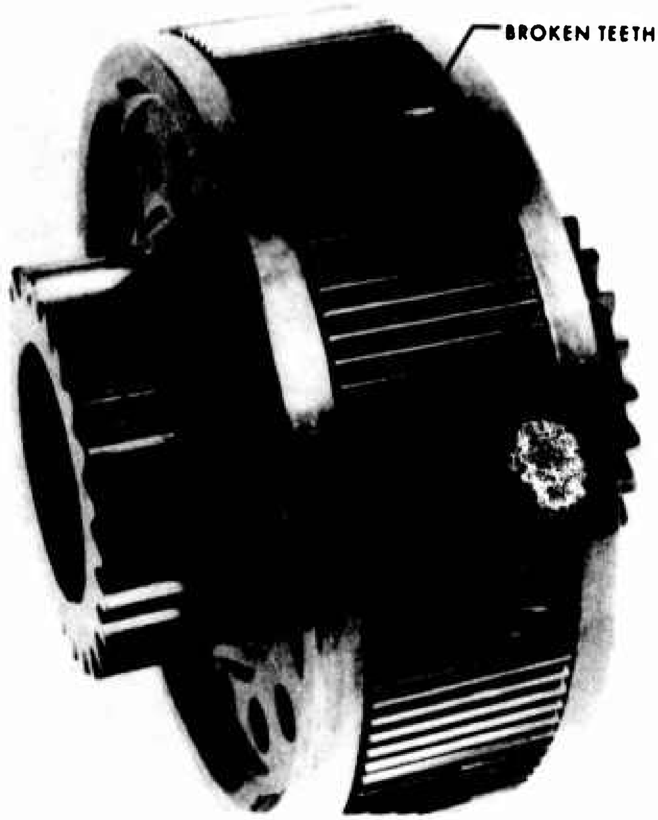


Figure 76. Gear Teeth Damage - Second-Row Pinion.

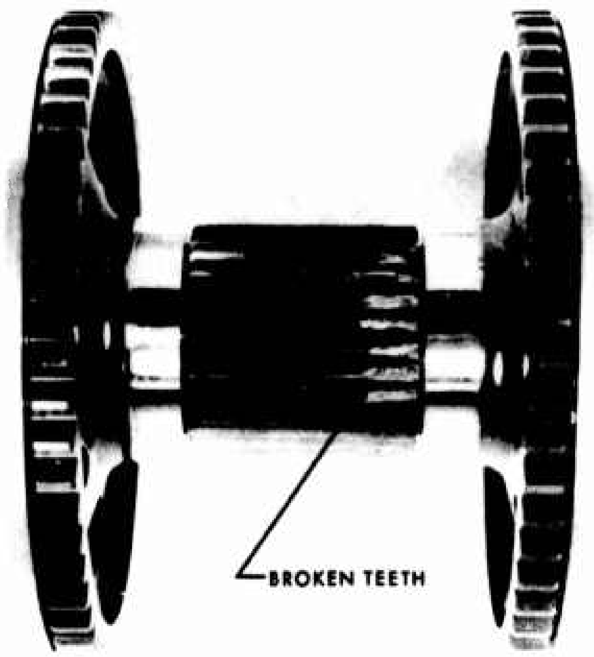


Figure 77. Gear Teeth Damage - First-Row Pinion.

Visual inspection of the test roller gear unit showed all parts to be in excellent condition. Magnetic particle inspection of the sun and first-row pinions failed to reveal any surface orientated cracks; it did, however, reveal cracks in the gear/flange assemblies of second-row pinions serial numbers 34 and 40 in the same area where the fracture of serial number 32 occurred. Subsequent examination of second-row gear/flange assemblies used during the initial test revealed similar cracks in serial numbers 12 and 15. Figure 78 shows the crack found in serial number 12 which is typical. The 0.25-inch-wide wear band on the 5.20-inch diameter is caused by the spacer which clamps the outer race of the spherical bearing.

Dimensional Inspection

To check if any undue wear had occurred in the dummy gearbox roller gear unit, a dimensional inspection of the rollers was conducted which revealed no wear of the surface.

Metallurgical Inspection

Metallurgical examination of the second-row gear assembly, serial number 32, revealed a fracture in the weld area between the gear and flange extending for the entire circumference of the gear. Fracture examination revealed fatigue cracking originating at the end of the weld zone as indicated in Figure 79. Evident in the fracture is a machined surface, Figure 80. A cross-sectional sample through the weld revealed that the weld beam had missed the joint between the mating components, as indicated in Figure 81 and Figure 82. Examination revealed that while complete weld beam penetration had been accomplished, fusion had not occurred where the center of the weld beam missed the mating surfaces. Metallographic examination of the microstructure in this area revealed an as-cast weld zone of typical core structure in the mating components. Hardness of the flange, gear and weld zone measured R_C 40, 38 and 40, respectively. Examination of gear/flange assembly serial number 40 shows a crack propagating from the end of the weld through the weld heat affect zone as seen in Figures 83 and 84.

It was concluded that fracture occurred because of incomplete fusion on the exit side of the weld.

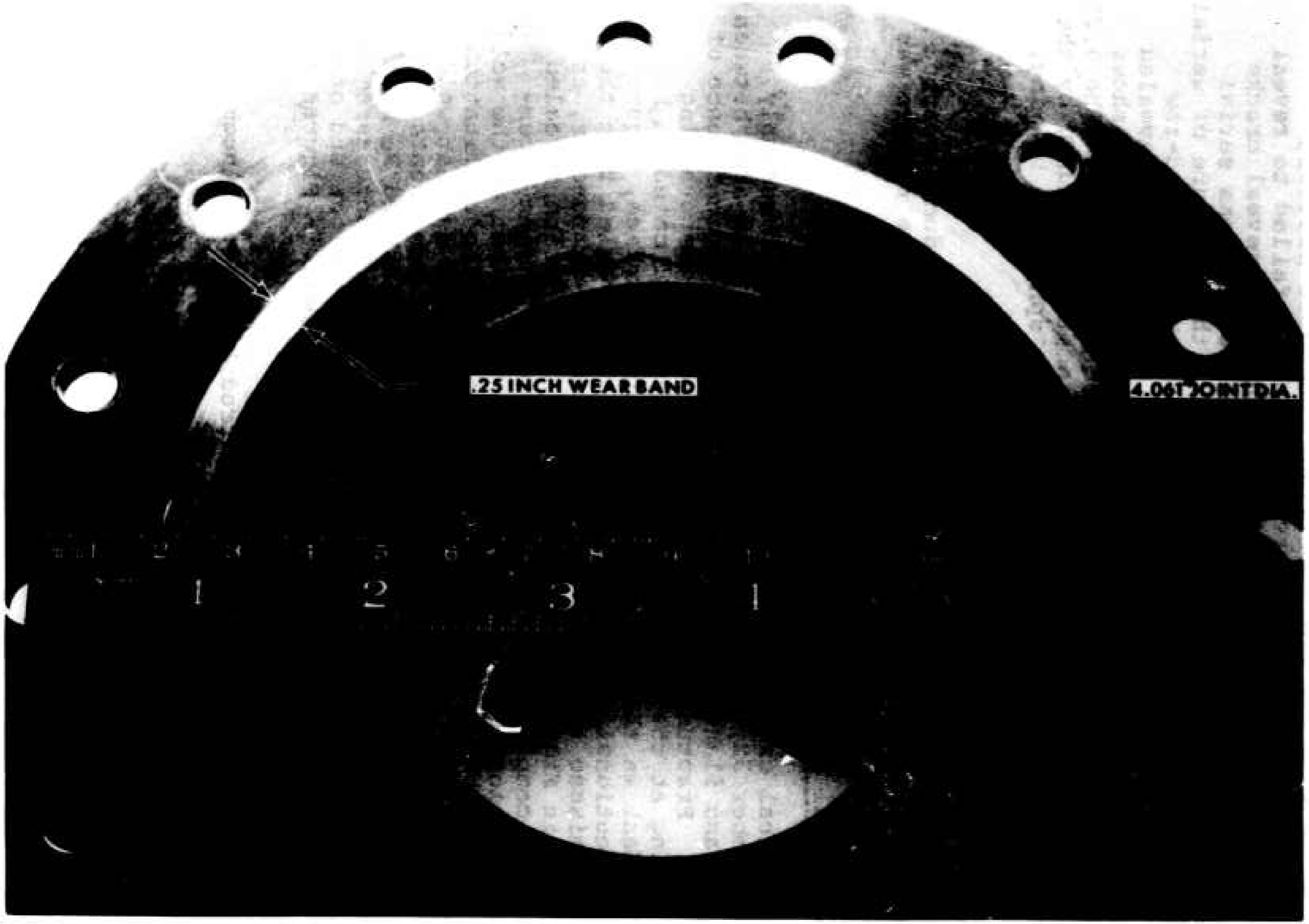


Figure 78. Gear/Flange Assembly - Second-Row Pinion.

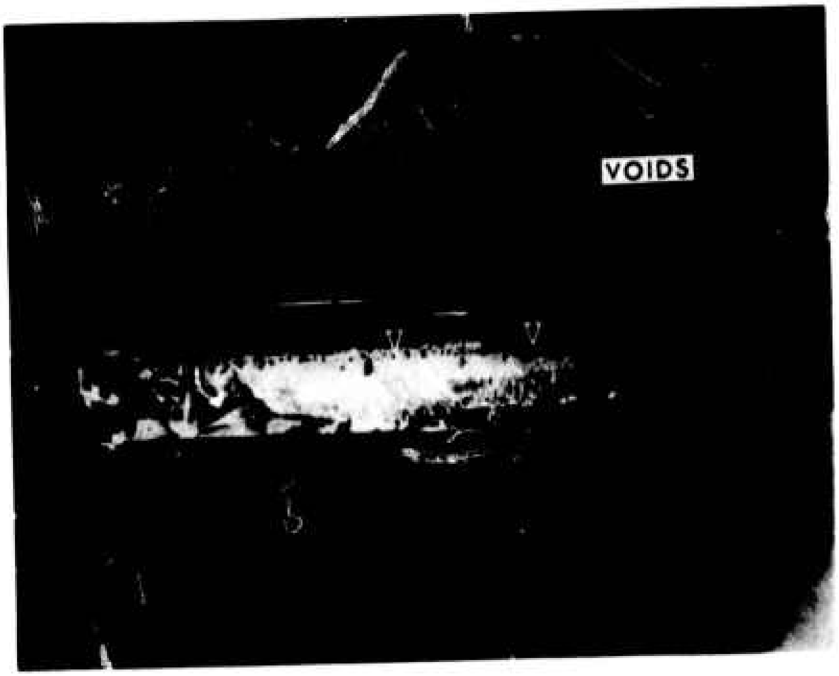


Figure 79. Fatigue Crack Origin - Second-Row Pinion.

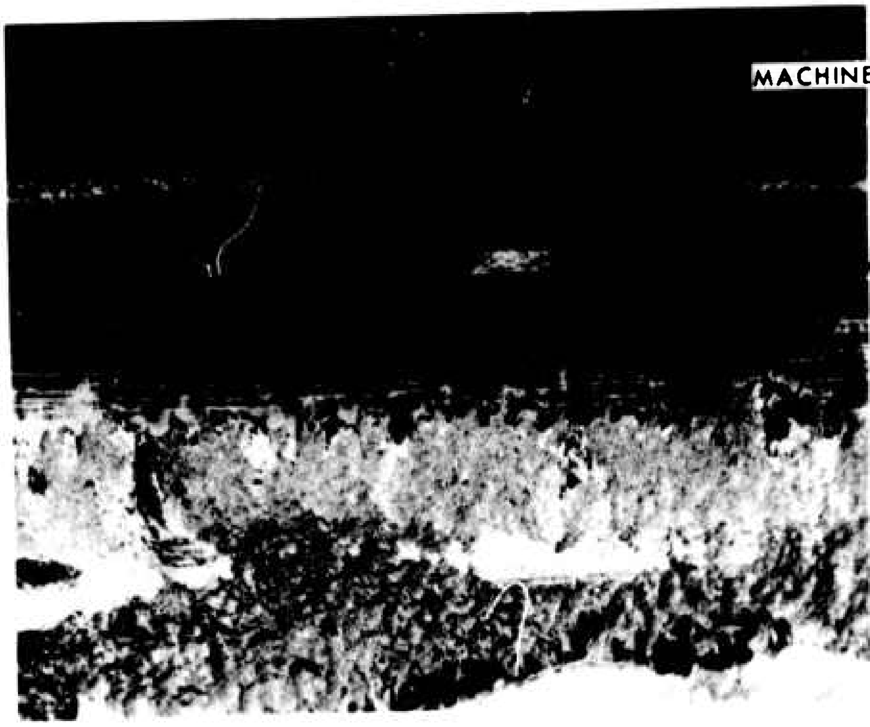


Figure 80. Machined Diameter - Fractured Section - Second-Row Pinion.

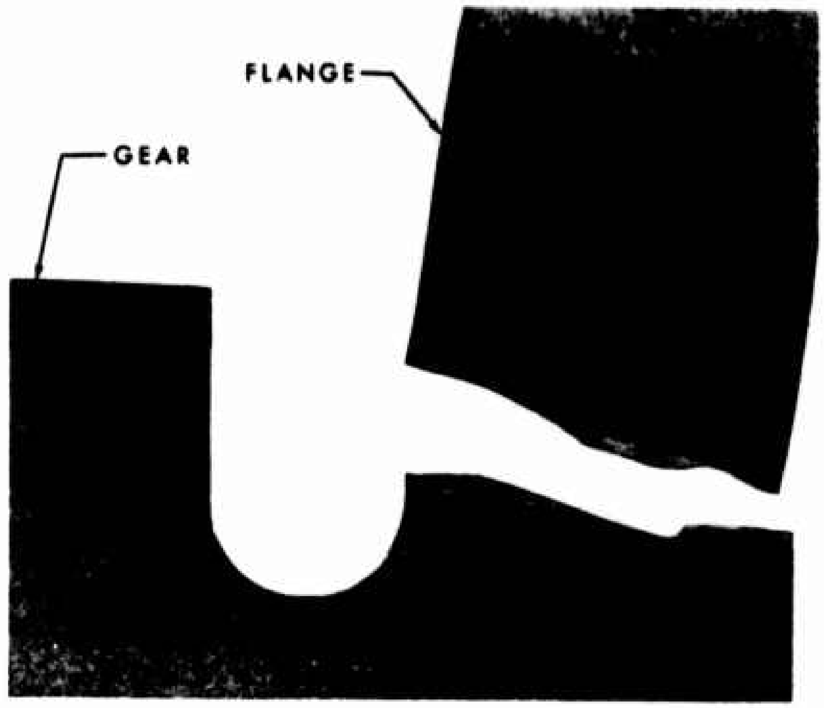


Figure 81. Gear/Flange Separation - Second-Row Pinion.

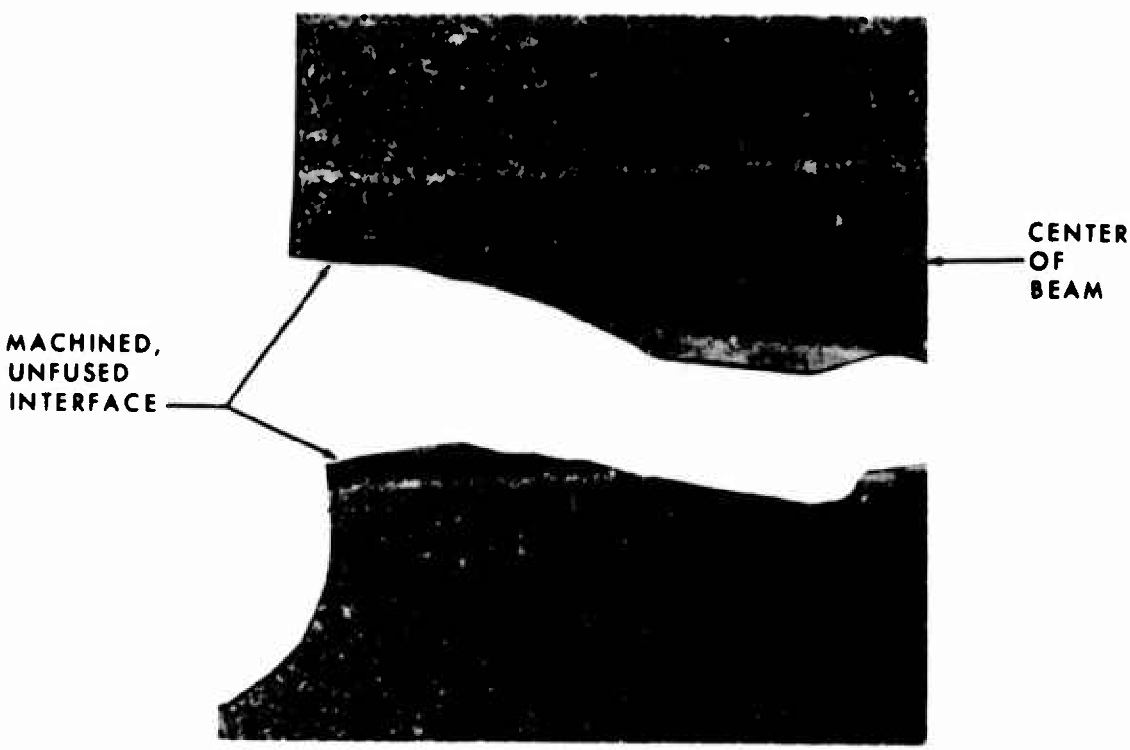


Figure 82. Electron Beam Weld - Gear/Flange, Second-Row Pinion.

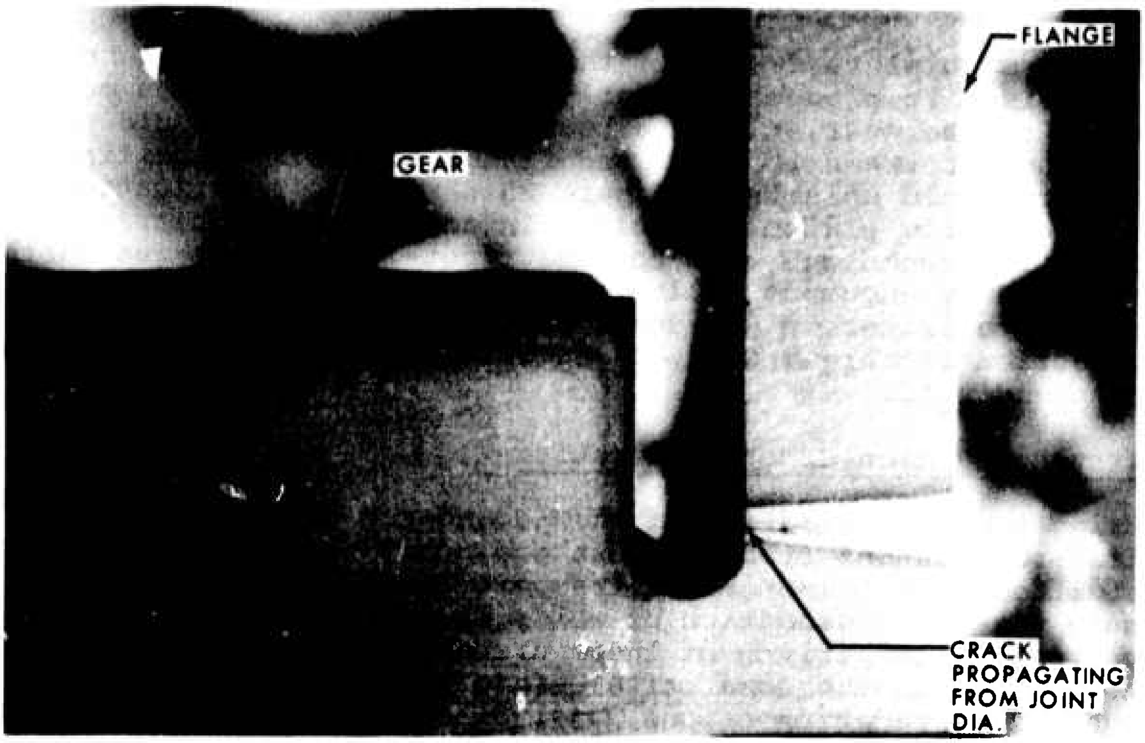


Figure 83. Crack - Gear/Flange Assembly, Second-Row Pinion.

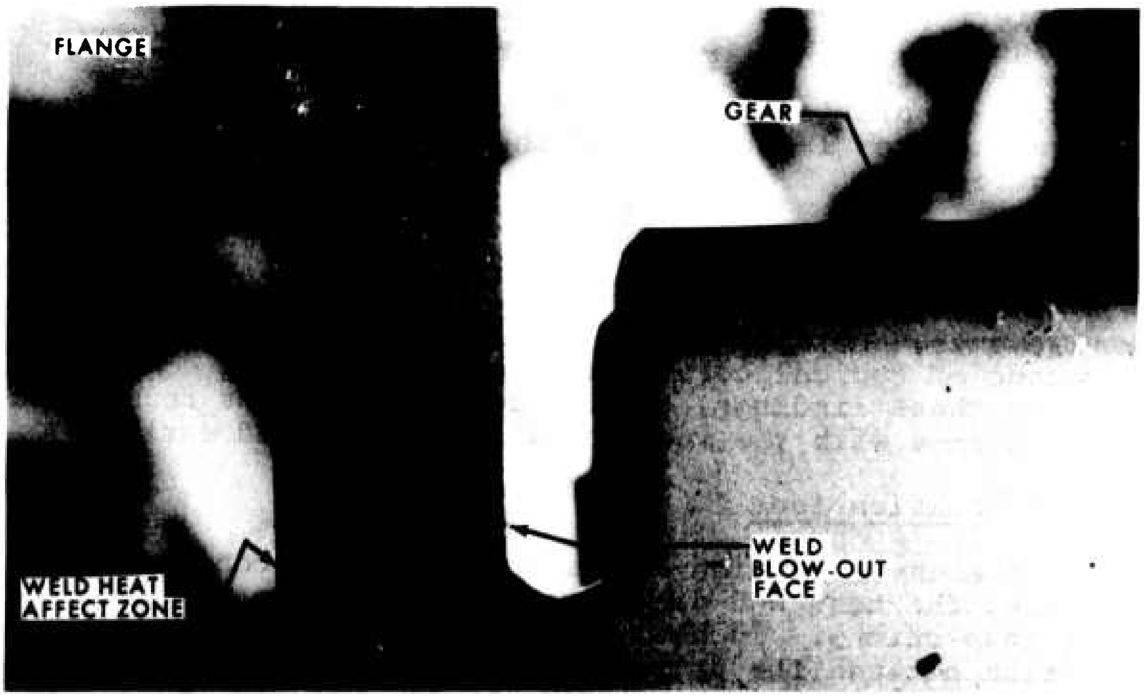


Figure 84. Crack Propagation - Gear/Flange Assembly, Second-Row Pinion.

Modification, Second-Row Pinion

To ensure complete fusion of this joint, the welding schedule was revised to produce a wider joint. This required a modification to the gear so that a heavier blast shield could be positioned between the gear and flange to protect the finish gear from weld splatter. Figure 85 shows the modification to the second-row pinion assembly. In addition, the ultrasonic inspection technique used for the first-row pinions was further developed to encompass all electron beam welded joints, and an acceptance criterion was developed. The resulting ultrasonic inspection technique and weld acceptance criterion are presented in Appendix II.

First-Row Pinion Crack Propagation

During the investigation of the second-row pinion fracture, first-row pinions from the test and dummy gearboxes were submitted to a pulse-echo ultrasonic inspection to determine if there was any degradation of welds during the 9.5 hours of testing. A comparison of these ultrasonic recordings with those taken on the same parts before testing was initiated revealed degradation of one small diameter roller of first-row pinion serial number 28, as shown in Figures 86 and 87. Laboratory sectioning to remove the roller to determine the cause for the change in the ultrasonic output revealed a 1.5-inch crack in the area of the weld. The crack extended the width of the roller. Figure 88 shows the crack at a section through the roller/gear interface, and Figure 89 shows the crack extending to a section taken at the shoulder of the small diameter roller. Separation of the crack revealed fatigue cracking propagating from large voids in the weld, as shown in Figure 90 and Figure 91.

These are the voids which had been recorded by the ultrasonic inspection. Hardnesses of the gear, component, and weld zone were R_C 38, 40 and 36, respectively, which conforms to core requirements. Metallographic examination revealed an as-cast weld zone of typical core structure in the mating components. Based on these findings, the first-row pinion was redesigned in accordance with the recommendations specified earlier.

Gearbox Modifications

During the investigation of the roller gear second-row pinion fracture, the test and dummy transmissions were subjected to split inspections. In both gearboxes fatigue fretting was occurring between the splines of the outer shaft and quill shaft. To arrest this condition, an oil dam was installed in the outer shaft, which forced oil to flow out through the spline instead of over the top of the outer shaft.

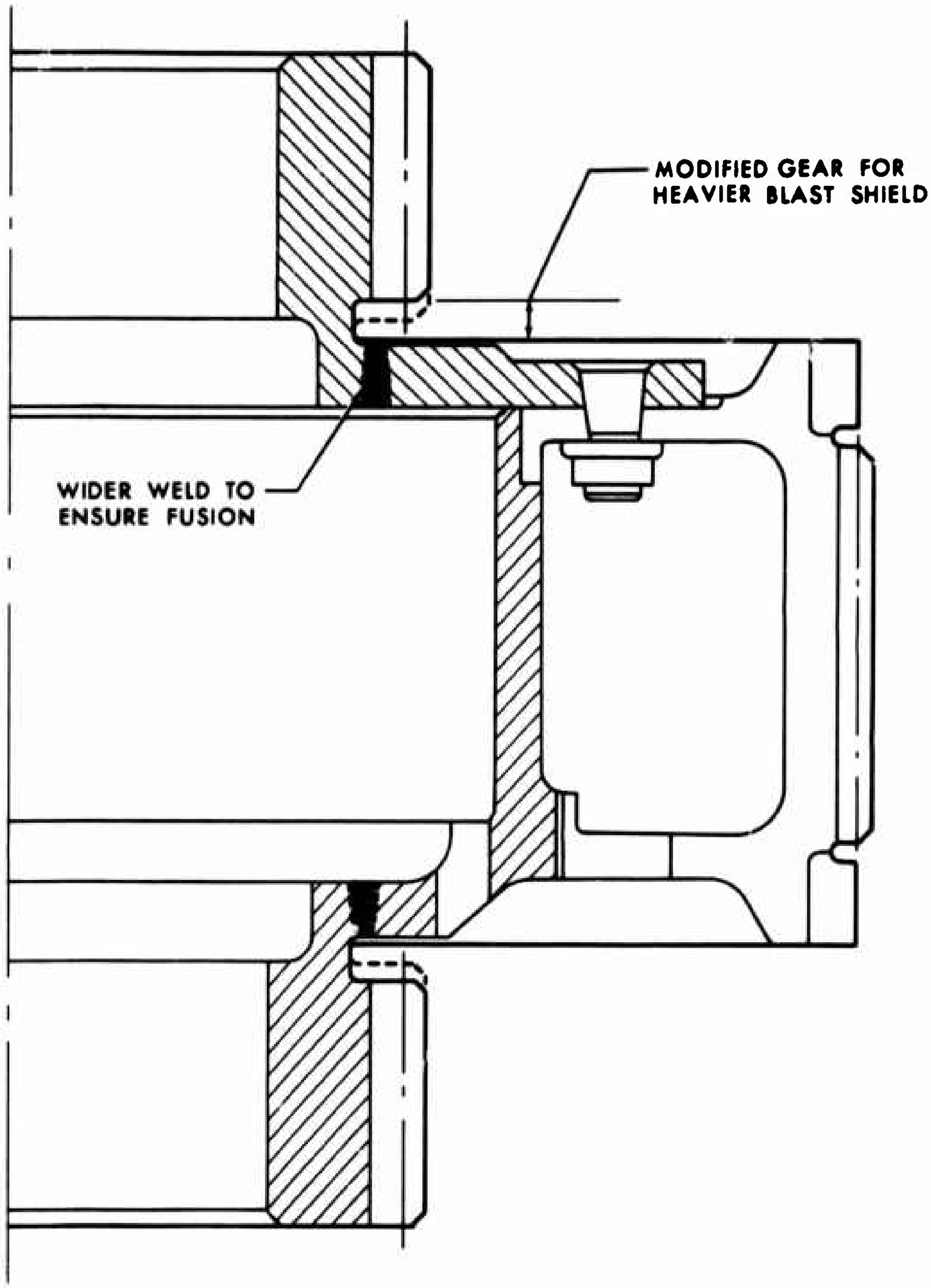


Figure 85. Second-Row Pinion Modification.

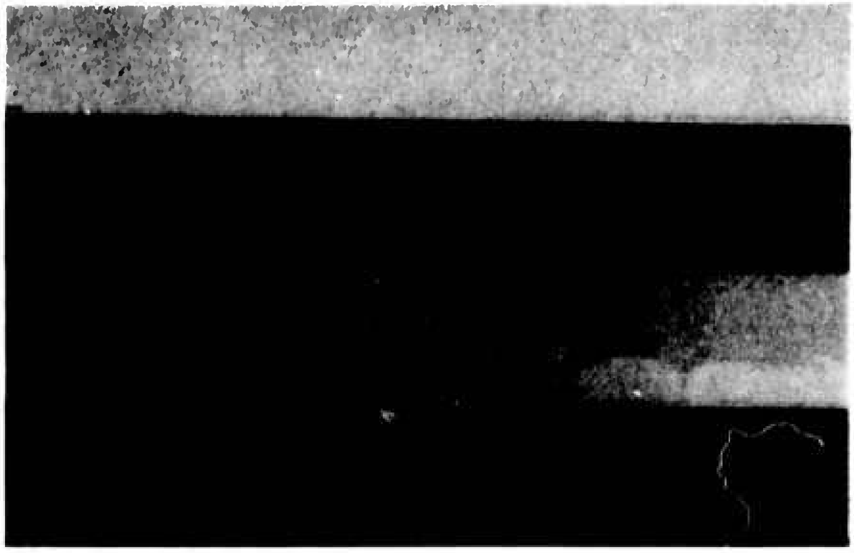


Figure 86. Ultrasonic Recording - First-Row Pinion Roller Weld, Small Diameter Roller.

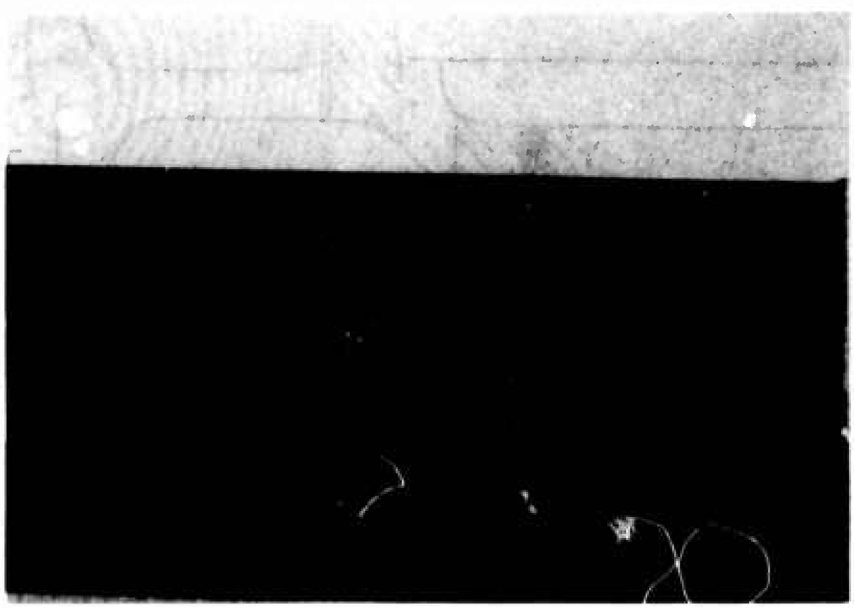


Figure 87. Weld Degeneration - Ultrasonic Recording, First-Row Pinion Roller Weld, Small Diameter Roller.

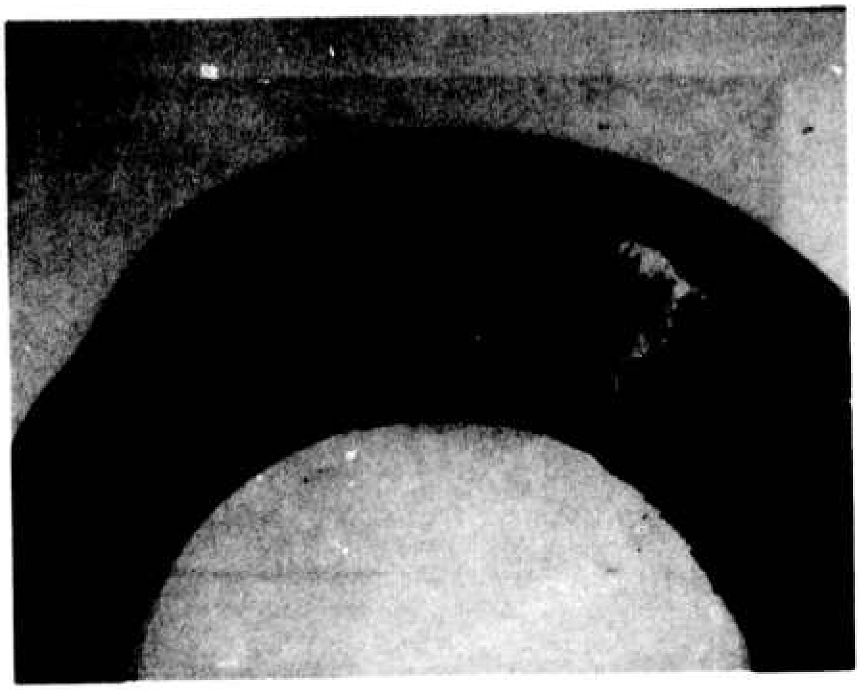


Figure 88. Crack - Roller/Gear Interface, First-Row Pinion.

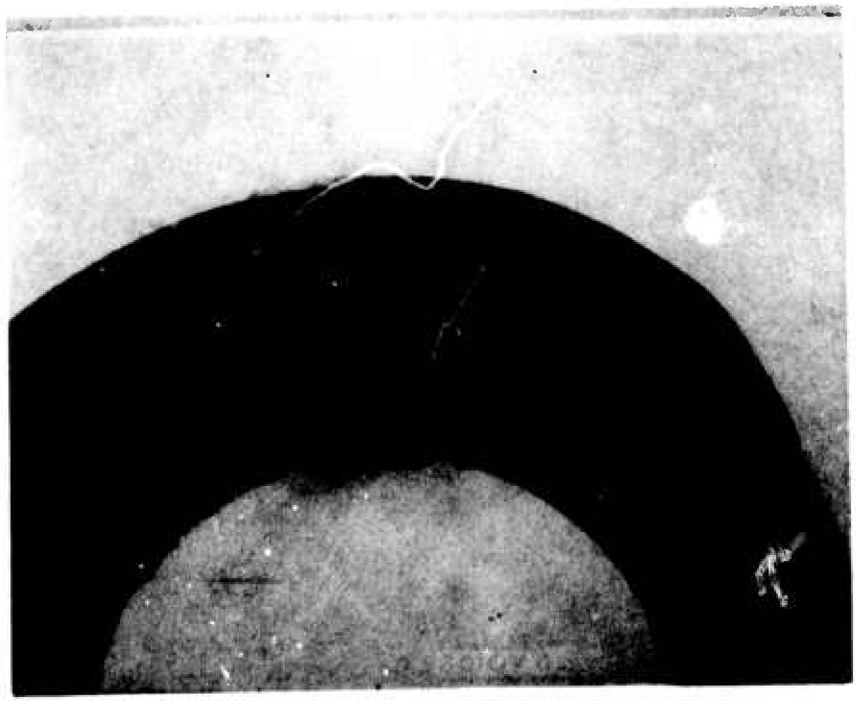


Figure 89. Crack - Roller Shoulder Section, First-Row Pinion.

Figure 90. Crack Interface - First-Row Pinion Roller.

Figure 91. Void, Electron Beam Weld - First-Row Pinion.

Inspection of the test gearbox freewheel units revealed 0.060-inch-wide wear paths on both ends of the rollers, Figure 92. These marks were caused by "chucking" of the rollers in the cage slots due to insufficient load on the cage during free-wheeling operations. Stronger springs were installed which increased the load on the cage in the freewheel position from 4 pounds to 6 pounds.

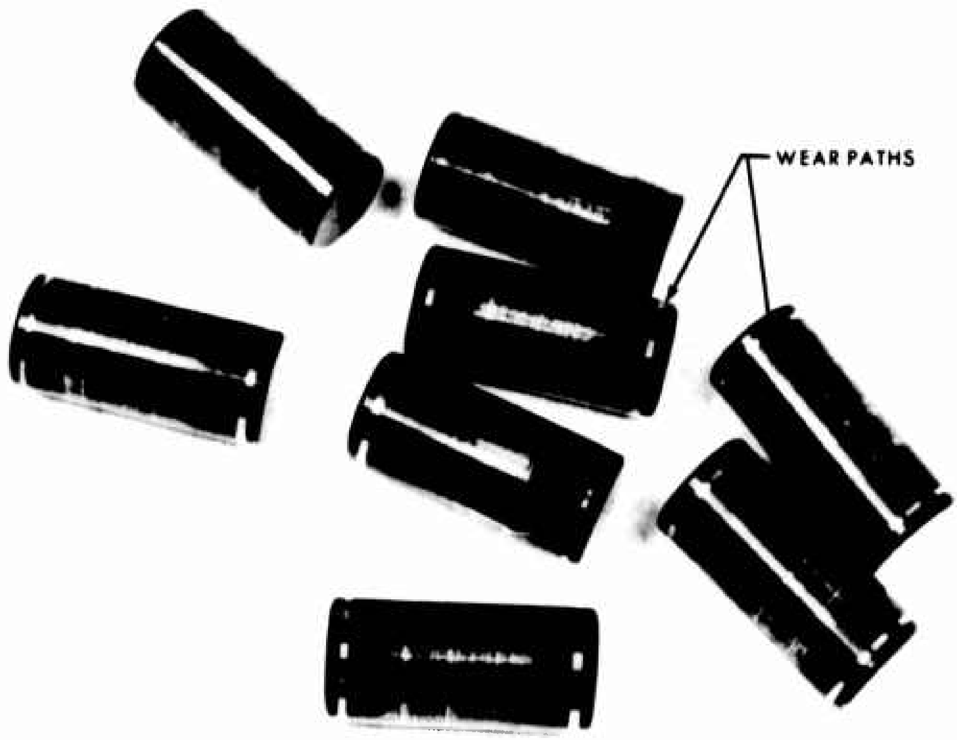


Figure 92. Rollers - Input Freewheel Unit.

Ultrasonic Inspection, Second-Row Pinion

Ultrasonic inspection of new second-row pinions revealed the presence of an unwelded section in the lower roller weld of pinion serial number 56. The ultrasonic recording shows an unfused arc 2.0 inches long. Removal of roller material from both sides of the unwelded area and machining 0.050 inch off the face of the roller allowed the unwelded portion to fall off. A cosmetic weld which had penetrated 0.045 inch had prevented detection of the subsurface crack by magnetic particle inspection. It was concluded that during welding, the electron beam was withdrawn prior to completion of the 360-degree weld. A cosmetic weld then covered all trace of the previous weld. This gear assembly was replaced by a second-row pinion assembly which had been manufactured as a spare.

Magnetic Particle Inspection, Second-Row Pinion

Prior to installation of these gears in the roller gear transmission, they were subjected to magnetic particle inspection which revealed longitudinal cracking on the inside diameter of the bearing bore, Figure 93. Examination of other second-row pinions which were in the process of rework revealed similarly located indications of cracking.

Metallurgical examination revealed that the cracks were multiple in nature, as shown in Figure 94, and typical of cracks associated with grinding stresses. Several assemblies evidenced a series of deeper circumferential cracks extending for approximately 1.5 inches as shown in Figure 95. Examination of cross sectional metallurgical specimens revealed the longitudinal cracks to be between 0.0007 - 0.001 inch deep. The circumferential cracks measured approximately 0.025 - 0.030 inch deep. All of the cracking was confined to a band 0.44 inch wide, which coincided with the weld zone which is located below this area, Figure 96. There was no cracking evident on the remaining surface area. Hardness of this surface measured uniformly R_C 56 across the width to within 0.25 inch of the edge where a hardness loss to R_C 50 was evident. The time span between the completion of manufacture, when magnetic particle inspection had last been performed, and detection of the cracking was approximately six months. It was concluded that cracking of these second-row gear assemblies was caused by residual stresses induced during manufacture, probably during the finish grinding operation.

Since the indications occurred in an area of redundant load support structure, removal of the cracked metal by machining would not be detrimental to the life or function of the part. On this basis the magnaglow indications were removed by machining 0.040 inch off the bore diameter for a depth of 0.50 inch. An extended stress relieving cycle, in which the parts were subjected to a 23-hour bake at 325° F, was conducted to alleviate any residual stresses that could have formed during the rework.

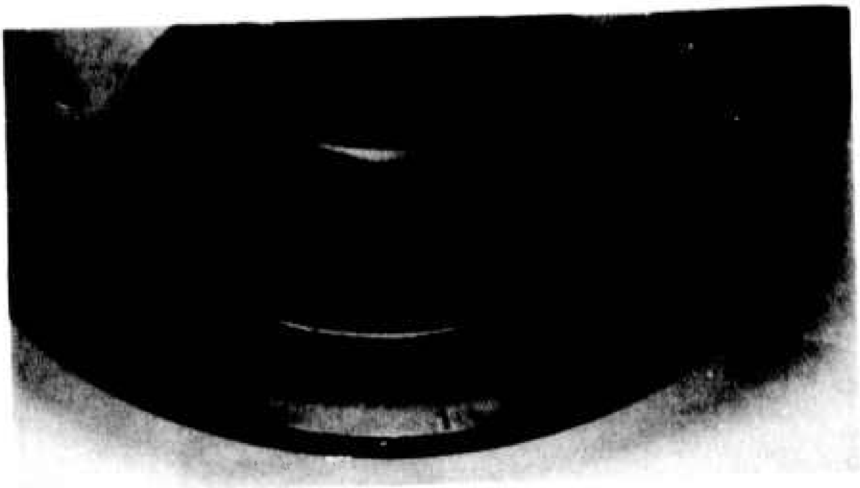


Figure 93. Bearing Bore Cracks - Second-Row Pinion.

Figure 94. Longitudinal Cracks - Bearing Bore.

Figure 95. Circumferential Cracks - Bearing Bore.

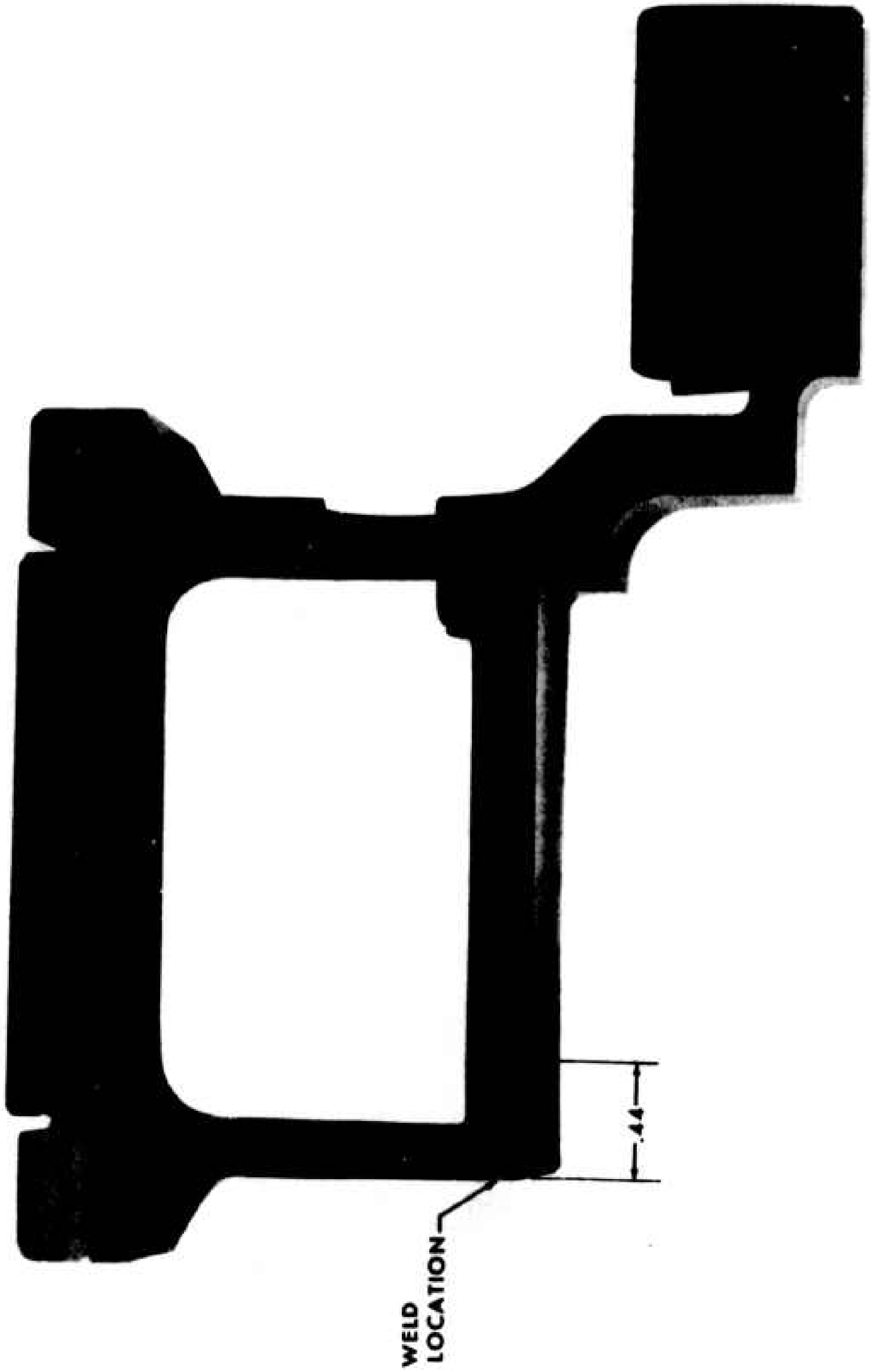


Figure 96. Crack Location - Second-Row Pinion.

Testing was continued with the redesigned first-row pinion gears installed in both gearboxes. A list of the replacement roller gear parts is presented in Tables XI and XII. Their locations in the test and dummy roller gear units are shown in Figures 97 and 98. The test was stopped after 20.9 hours of testing (56:56 total test time) when the oil pressure in the dummy gearbox manifold dropped below an acceptable level. At this time all chip detectors were examined. Metallic particles were found in the dummy transmission forward sump chip detector, but were insufficient in number to trigger the detector. After investigation of the steel particles, it was decided to run at full speed low power to determine which pump was not delivering and to see if more chips would be generated. It was found that neither pump could generate enough output to take over from the test stand auxiliary pump which supplies lubrication oil until 40 psi is developed by the gearbox pumps, and the test was stopped after 2 minutes. Removal of the detectors showed an accumulation of more metallic particles in the sump chip detector. Consequently, the test was terminated and the gearboxes were removed from the test facility.

Visual Inspection

A review of the assembly procedure and inspection of the dummy roller gear unit, Figure 99, revealed that all timing marks on the gears were correctly oriented. Inspection of the partially disassembled unit, Figure 100, showed that first-row pinions serial numbers 14 and 15 had fractured teeth on the second-row mesh. Examination of each part showed the rollers to be in excellent condition, while gear patterns on the first-row pinions indicated load was distributed evenly across the face of the teeth.

TABLE XI. TEST #3 - ROLLER GEAR UNIT COMPONENTS - TEST GEARBOX

Part Number	Nomenclature	Serial Number	Status	Test Hours:Minutes
RG351-11183-041	Sun Gear	09	New	0
RG351-11182-052	1st-Row Pinion	02	New weld config.	0
RG351-11182-052	1st-Row Pinion	06	New weld config.	0
RG351-11182-052	1st-Row Pinion	09	New weld config.	0
RG351-11182-052	1st-Row Pinion	10	New weld config.	0
RG351-11182-052	1st-Row Pinion	11	New weld config.	0
RG351-11182-052	1st-Row Pinion	12	New weld config.	0
RG351-11182-052	1st-Row Pinion	16	New weld config.	0
RG351-11181-052	2nd-Row Pinion	01	Used in dummy box	26:30
RG351-11181-052	2nd-Row Pinion	10	Used in dummy box	26:30
RG351-11181-052	2nd-Row Pinion	16	Used in dummy box	26:30
RG351-11181-052	2nd-Row Pinion	17	Used in dummy box	26:30
RG351-11181-052	2nd-Row Pinion	19	Used in dummy box	26:30
RG351-11181-052	2nd-Row Pinion	23	Used in dummy box	26:30
RG351-11181-041	2nd-Row Pinion	07	Replacement for s/n 15	0
RG351-11184-041	Ring Gear	02	Used in Tests #1 & #2	36:0
22313 VAG	Spherical Bearing	N6	New	0
22313 VAG	Spherical Bearing	N7	New	0
22313 VAG	Spherical Bearing	N13	New	0
22313 VAG	Spherical Bearing	N21	New	0
22313 VAG	Spherical Bearing	N32	New	0
22313 VAG	Spherical Bearing	N39	New	0
22313 VAG	Spherical Bearing	N40	New	0

TABLE XII. TEST #3 - ROLLER GEAR UNIT COMPONENTS - DUMMY GEARBOX

Part Number	Nomenclature	Serial Number	Status	Test Hours:Minutes
RG351-11183-041	Sun Gear	03	Used in Test #2	9:30
RG351-11182-052	1st-Row Pinion	03	New weld config.	0
RG351-11182-052	1st-Row Pinion	04	New weld config.	0
RG351-11182-052	1st-Row Pinion	05	New weld config.	0
RG351-11182-052	1st-Row Pinion	08	New weld config.	0
RG351-11182-052	1st-Row Pinion	13	New weld config.	0
RG351-11182-052	1st-Row Pinion	14	New weld config.	0
RG351-11182-052	1st-Row Pinion	15	New weld config.	0
RG351-11181-051	2nd-Row Pinion	03	Used in Test #1	26:30
RG351-11181-051	2nd-Row Pinion	04	Used in Test #1	26:30
RG351-11181-051	2nd-Row Pinion	05	Used in Test #1	26:30
RG351-11181-051	2nd-Row Pinion	06	Used in Test #1	26:30
RG351-11181-051	2nd-Row Pinion	09	Used in Test #1	26:30
RG351-11181-051	2nd-Row Pinion	20	Used in Test #1	26:30
RG351-11181-051	2nd-Row Pinion	22	Replacement for s/n 12	0
RG351-11184-041	Ring Gear	04	Used in Tests #1 & #2	36:00
22313 VAG	Spherical Bearing	N4	New	0
22313 VAG	Spherical Bearing	N12	New	0
22313 VAG	Spherical Bearing	N17	New	0
22313 VAG	Spherical Bearing	N20	New	0
22313 VAG	Spherical Bearing	N29	New	0
22313 VAG	Spherical Bearing	N35	New	0
22313 VAG	Spherical Bearing	N36	New	0

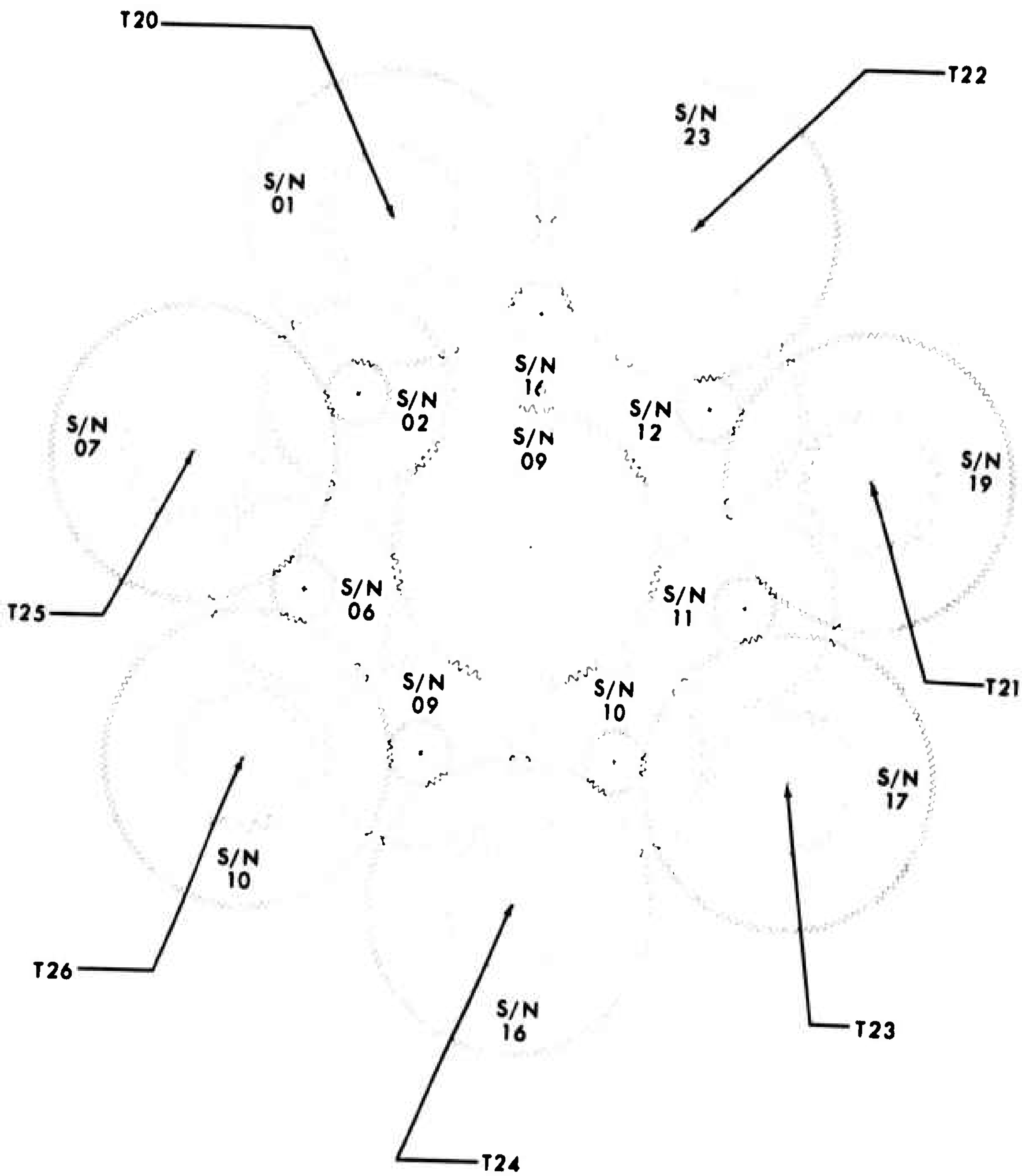


Figure 97. Component Location - Test Roller Gear Unit,

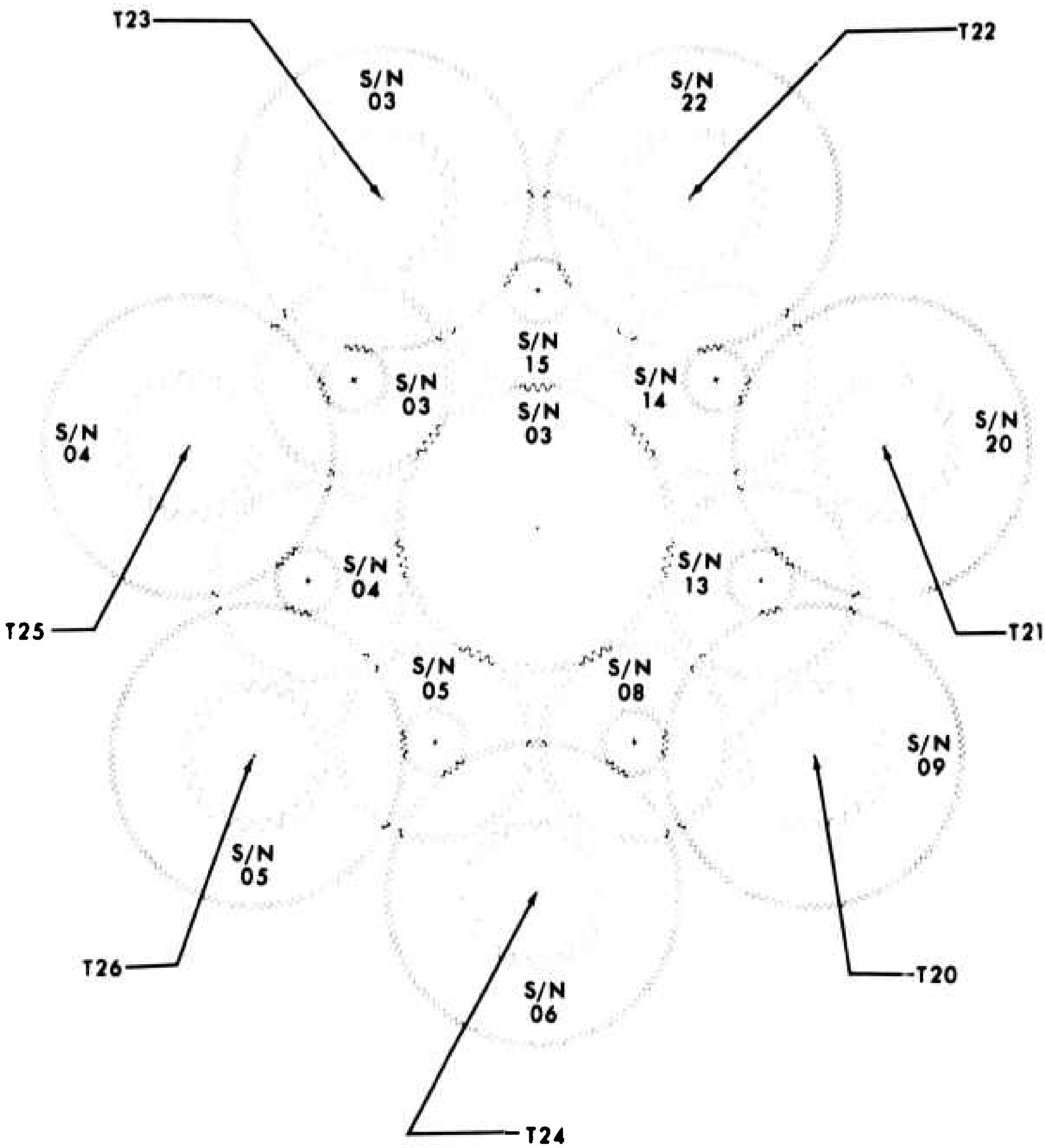


Figure 98. Component Location - Dummy Roller Gear Unit.

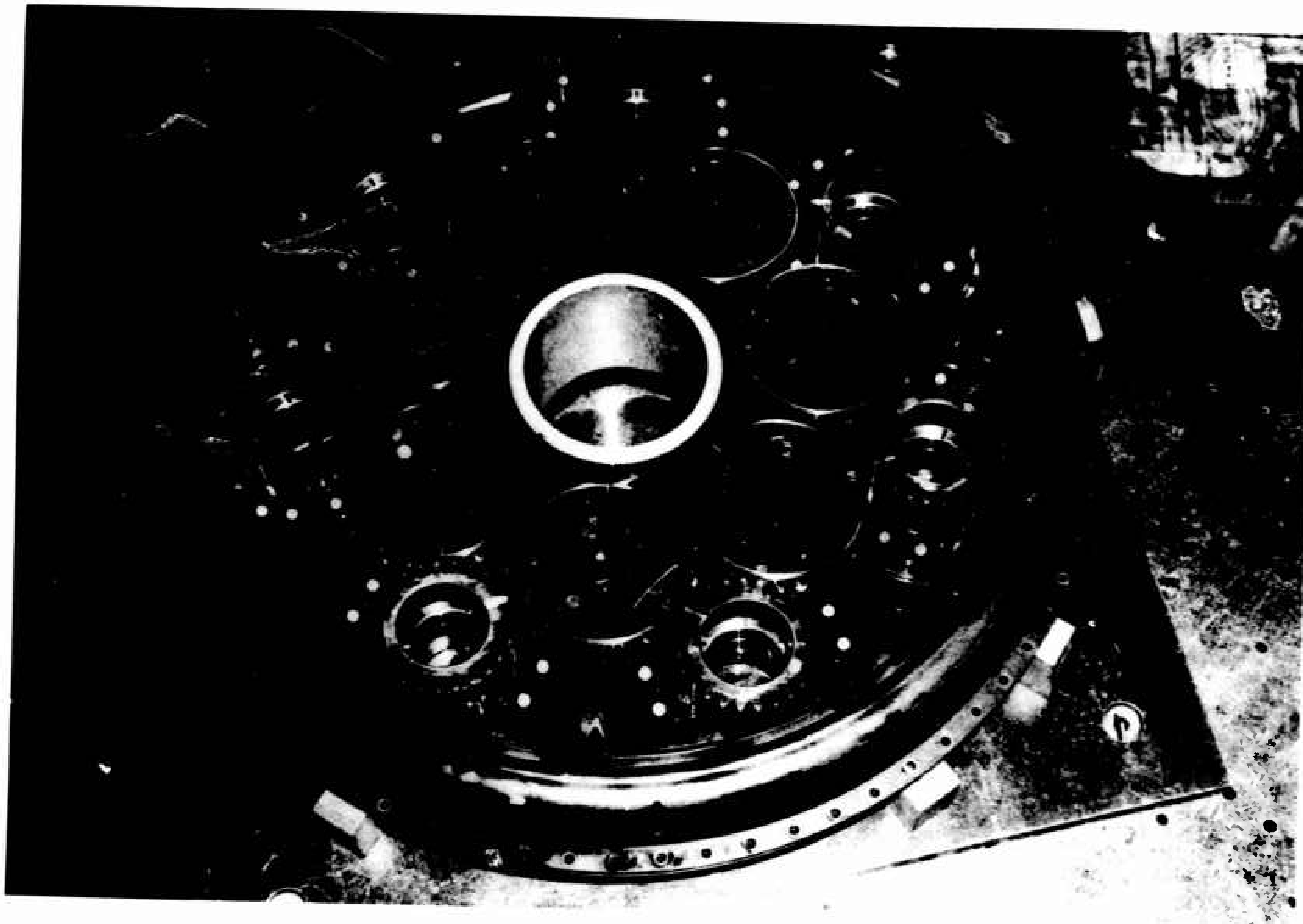


Figure 99. Roller Gear Unit - Dummy Gearbox.

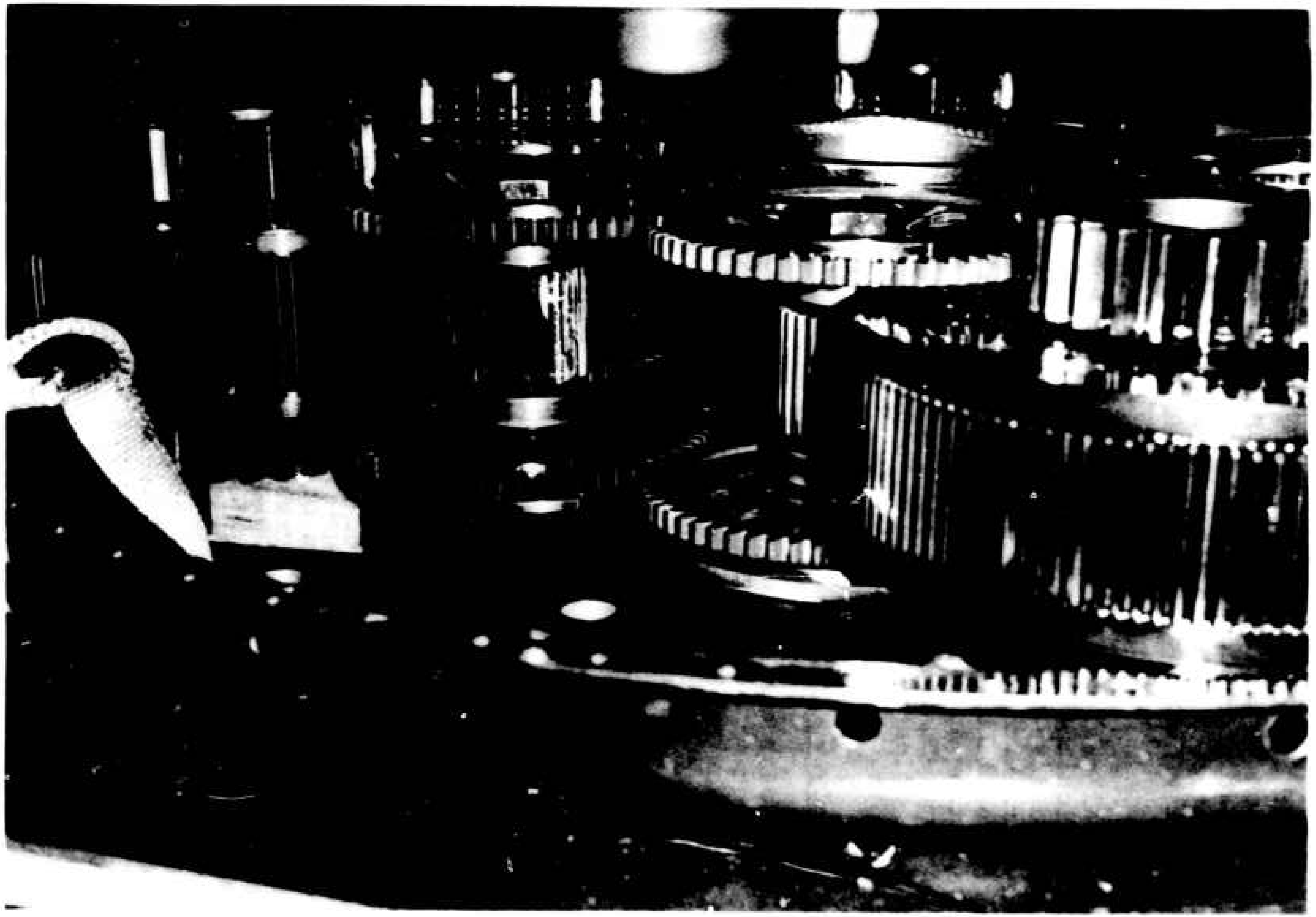


Figure 100. First-Row Pinion Damage - Roller Gear Unit.

Metallurgical Examination

Inspection of the fractured first-row pinion teeth revealed that the cracking had originated near the roots of the teeth where the heat affected zone adjacent to the weld had extended into the gear root, Figure 101. A plot of hardness readings, taken in the vicinity of the fracture origin, is shown in Figure 102.

Metallurgical analysis of the heat affected zone showed that transformation changes occurring during the welding process had resulted in an area of residual tensile stress. This created a transition interface where an area of compressive stress (carburized layer) bordered an area of tensile stress. This transition in the material, from a state of tension to a state of compression, led to a stress concentration at the edge of the heat affected zone which, in turn, led to the failure of the gear teeth.

Fracture Analysis

An analysis of tooth bending stress was performed to determine whether or not the allowable stress could have been exceeded at the point of failure in the heat affected zone. This analysis showed that while the allowable stress in this area had been decreased from 55,000 psi to 48,000 psi by heat from the weld, existing tooth bending stresses in the area were still below the allowable stress for a 3-sigma incidence of tooth failure. Torsional stress in this area was calculated to be 4000 psi, a value judged low enough to have had a negligible effect on the teeth. Bending stress due to overall loading of the gear was calculated to be 3,110 psi, also of negligible effect when resolved into the plane of tooth bending stress.

Modification of First-Row Pinion

Since the heat affected area is inherent in the welding process, design modifications of the first-row pinions were selected to reduce bending stresses in the heat affected area. To accomplish this, 0.032 inch was removed from the edge of the teeth, Figure 103. Secondly, the teeth were crowned to 0.0002 - 0.0005 inch across the face width. This was done to concentrate stresses in the center of the tooth, thus reducing stress at the ends of the teeth. In addition, the heat affected zone was shot-peened to put the surface in compression.

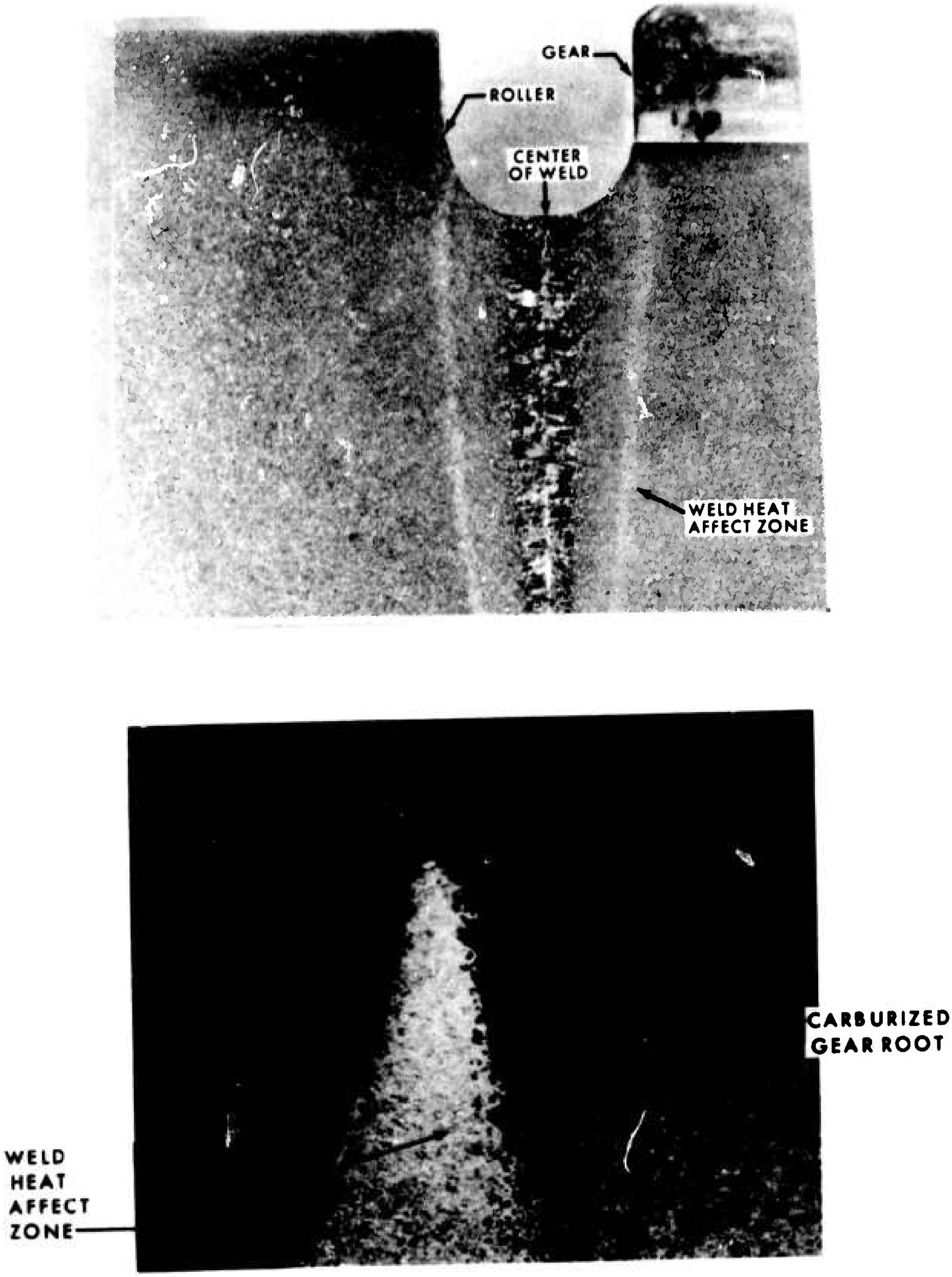


Figure 101. Butt Weld - First-Row Pinion.

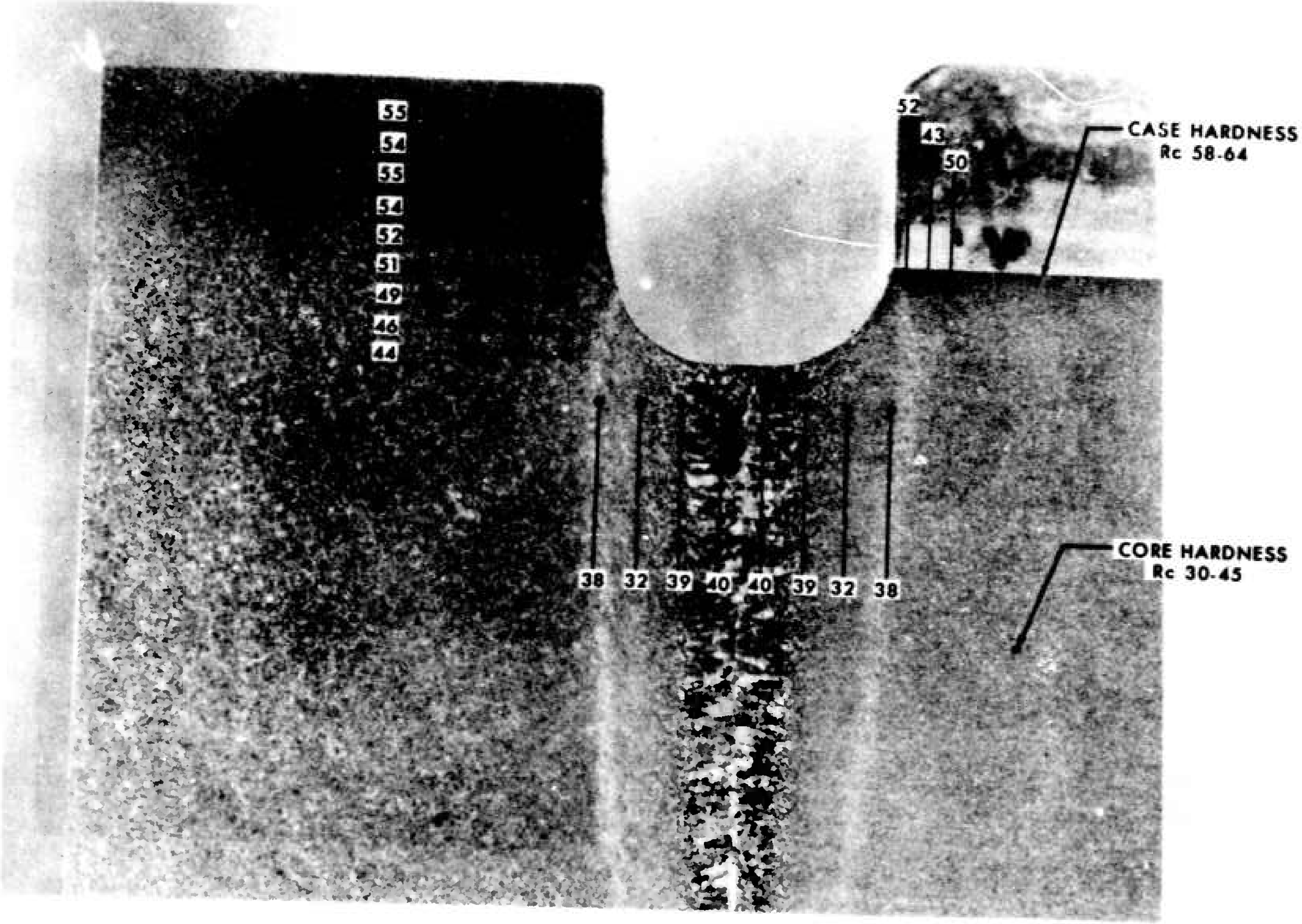


Figure 102. Microhardness Survey - Butt Weld, First-Row Pinion.

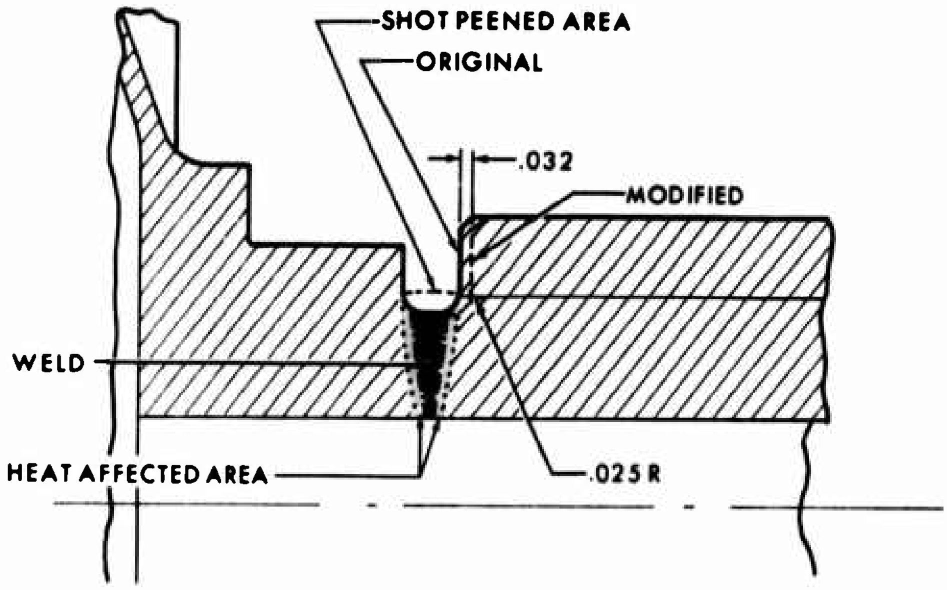


Figure 103. First-Row Pinion Modification.

Oil Pump Malfunction

Further inspection showed that the loss of lubrication was due to the fracture of the quill shaft driving the aft lubrication pump. This pump had seized when metal fragments from the fractured first-row pinion teeth entered the operating area of the vanes. The metallic particles were cold welded to the cam ring, thereby preventing rotation of the vanes, Figure 104, and sheared the quill shaft. It was discovered that the pump chip detector had been incorrectly installed, allowing the metallic fragments to enter the pump itself. On reassembly this problem was corrected.

With the implementation of these modifications, the initial testing was completed. Test time accumulated during initial test and the gear development test totaled 56:56.

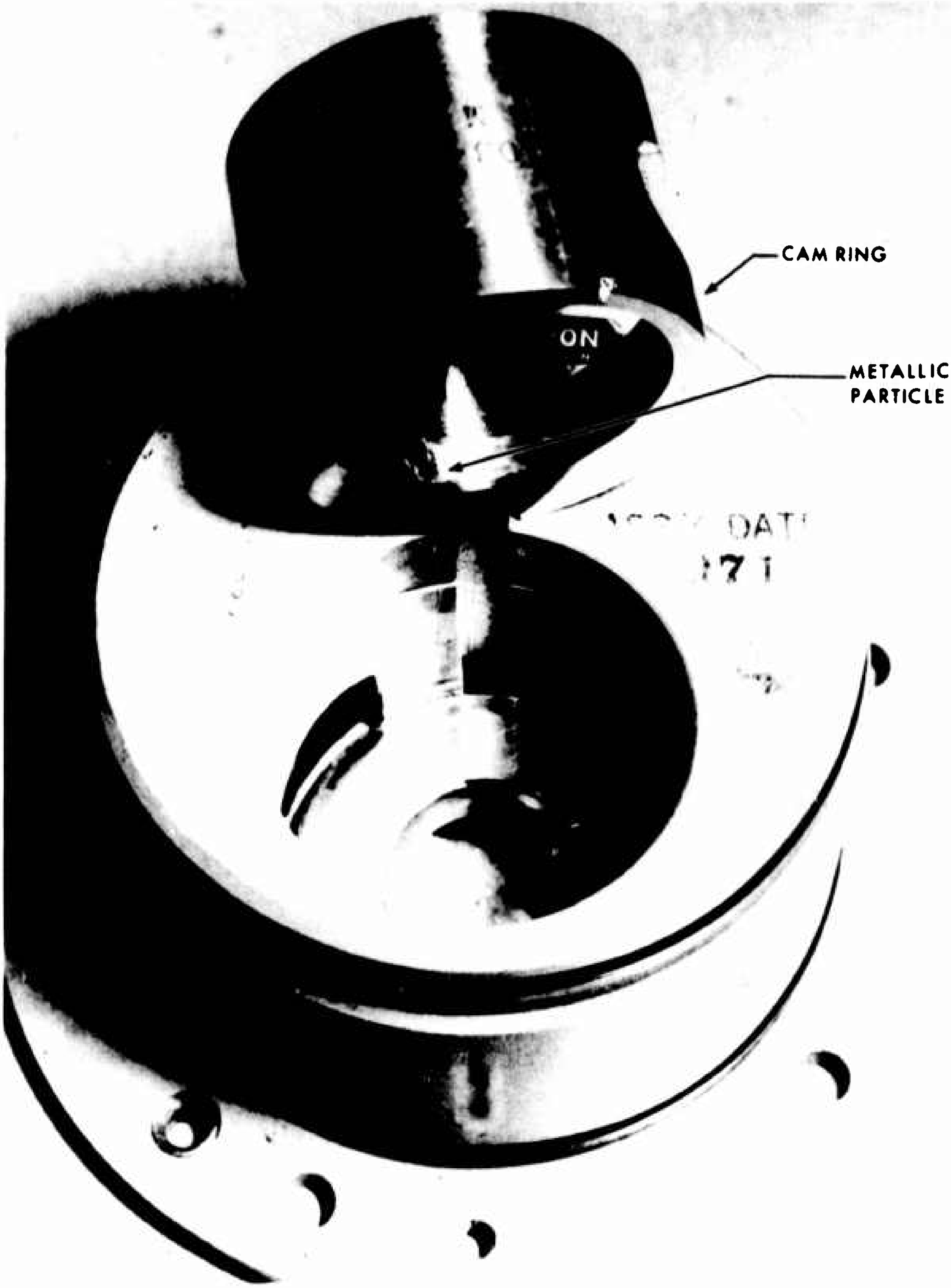


Figure 104. Disassembled Lubrication Pump - Roller Gear Transmission.

200-HOUR ENDURANCE TEST

The 200-hour endurance test was initiated upon the completion of modifications resulting from the earlier development testing. The components assembled into the test and dummy roller gear units, Tables XIII and XIV, contained first- and second-row pinions to the latest design configuration. These were located within the test and dummy roller gear units as shown in Figures 105 and 106. After 110 hours of trouble-free endurance test operation, during which the gearboxes were subjected to the test spectrum of Table XV, the test stand was shut down at 166:56 total test time for scheduled inspection of the gearboxes. Both gearboxes were removed from the test stand and partially disassembled. The roller gear units were removed and examination revealed no signs of distress. The gearboxes were reassembled and the endurance test was continued.

After an additional 40 hours of testing as per Table XVI, testing was stopped at 206:56 total test time for a problem in the tail takeoff adaptor gearbox of the dummy transmission. Inspection of this gearbox revealed a severely spalled idler shaft bearing, Figure 107. The bearing was replaced after a check showed the bearing was receiving adequate lubrication. The rest of the 200-hour endurance test, in accordance with the spectrum of Table XVII, was completed without incident.

Included as part of the 200-hour endurance test was a survey of the post loads of the second-row pinions in the test gearbox. Strain gages were installed in the pinion posts as shown in Figure 25, and the signals from these fed into an oscillograph. The results of the survey are shown in the graph of Figure 108 which plots post tangential load versus transmitted power. The tangential loads closely agreed with the loads obtained through analysis. While accurate radial load readings were difficult to obtain because of interference between the strain gages, the measurements indicated them to be approximately 5 percent of the tangential loads. Load distribution among the seven posts was excellent, with a maximum deviation from the mean of 5 percent.

Upon completion of the 200-hour endurance test at 256:56 total test time, both gearboxes were disassembled for detailed inspection. This encompassed visual, magnaglow, and ultrasonic inspection of welded components. The results of these inspections are presented in Tables XVIII and XIX for the test and dummy gearboxes, respectively.

TABLE XIII. 200-HOUR ENDURANCE TEST - ROLLER GEAR UNIT COMPONENTS - TEST GEARBOX

Part Number	Nomenclature	Serial Number	Status	Test Hours:Minutes
RG351-11183-041	Sun Gear	09	Used in Test #3	20:54
RG351-11182-062	1st-Row Pinion	33	New	0
RG351-11182-062	1st-Row Pinion	35	New	0
RG351-11182-062	1st-Row Pinion	39	New	0
RG351-11182-062	1st-Row Pinion	42	New	0
RG351-11182-062	1st-Row Pinion	43	New	0
RG351-11182-062	1st-Row Pinion	48	New	0
RG351-11182-062	1st-Row Pinion	49	New	0
RG351-11181-062	2nd-Row Pinion	29	New	0
RG351-11181-062	2nd-Row Pinion	38	New	0
RG351-11181-062	2nd-Row Pinion	48	New	0
RG351-11181-062	2nd-Row Pinion	49	New	0
RG351-11181-062	2nd-Row Pinion	53	New	0
RG351-11181-062	2nd-Row Pinion	57	New	0
RG351-11181-062	2nd-Row Pinion	58	New	0
RG351-11184-041	Ring Gear	02	Used in Tests #1,2,3	56:54
22313 VAG	Spherical Bearing	N4	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N12	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N17	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N20	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N29	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N35	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N36	Used in Test #3	20:54

TABLE XIV. 200-HOUR ENDURANCE TEST - ROLLER GEAR UNIT COMPONENTS - DUMMY GEARBOX

Part Number	Nomenclature	Serial Number	Status	Test Hours:Minutes
RG351-11183-041	Sun Gear	03	Used in Tests #2, 3	30:24
RG351-11182-062	1st-Row Pinion	36	New	0
RG351-11182-062	1st-Row Pinion	37	New	0
RG351-11182-062	1st-Row Pinion	38	New	0
RG351-11182-062	1st-Row Pinion	41	New	0
RG351-11182-062	1st-Row Pinion	44	New	0
RG351-11182-062	1st-Row Pinion	45	New	0
RG351-11182-062	1st-Row Pinion	46	New	0
RG351-11181-062	2nd-Row Pinion	01	Used in Tests #1, 3	47:24
RG351-11181-062	2nd-Row Pinion	07	Used in Test #3	20:54
RG351-11181-062	2nd-Row Pinion	10	Used in Tests #1, 3	47:24
RG351-11181-062	2nd-Row Pinion	16	Used in Tests #1, 3	47:24
RG351-11181-062	2nd-Row Pinion	17	Used in Tests #1, 3	47:24
RG351-11181-062	2nd-Row Pinion	19	Used in Tests #1, 3	47:24
RG351-11181-062	2nd-Row Pinion	23	Used in Tests #1, 3	47:24
RG351-11184-041	Ring Gear	04	Used in Tests #1,2,3	56:54
22313 VAG	Spherical Bearing	N6	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N7	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N13	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N21	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N32	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N39	Used in Test #3	20:54
22313 VAG	Spherical Bearing	N40	Used in Test #3	20:54

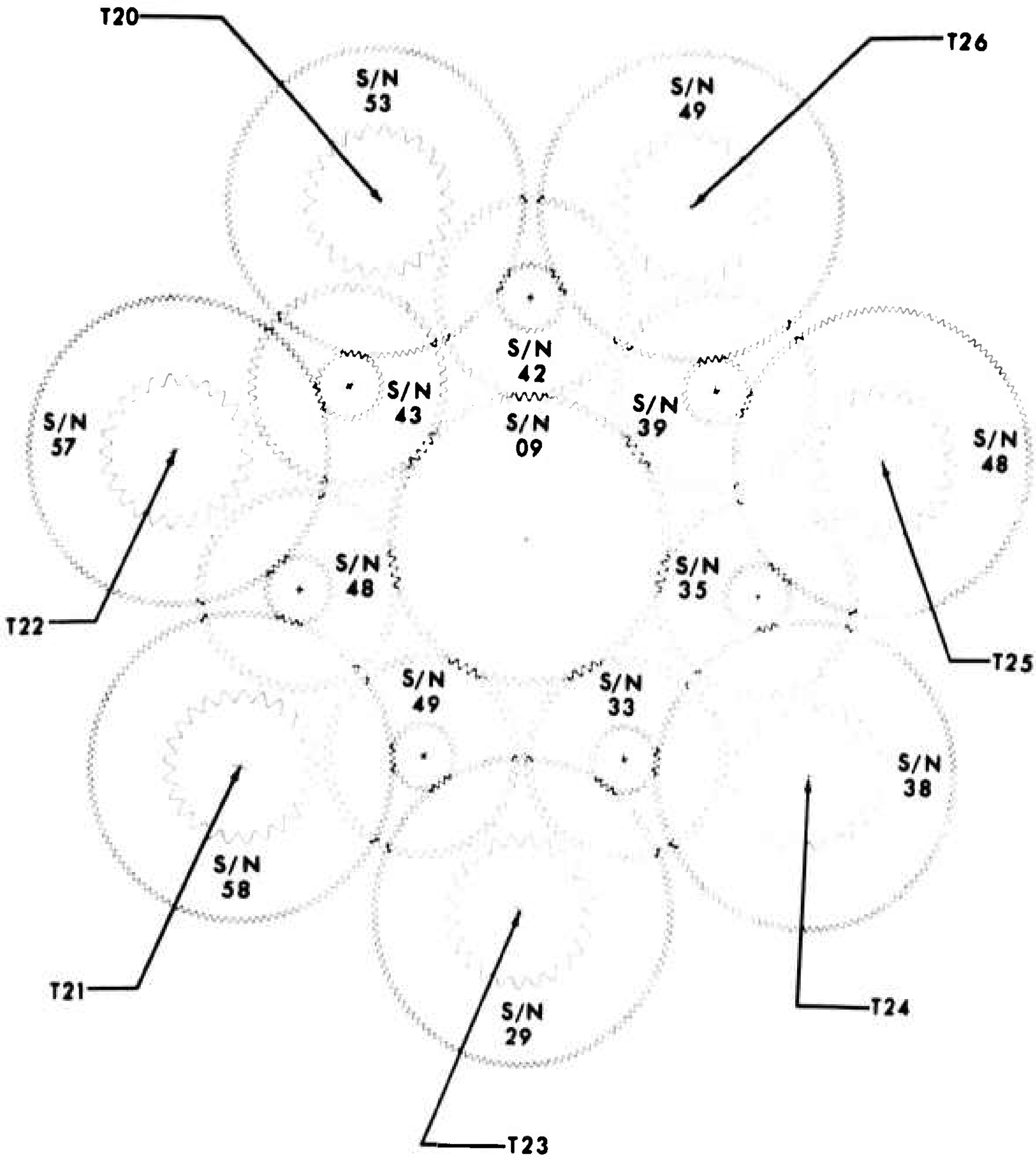


Figure 105. Component Location - Test Roller Gear Unit.

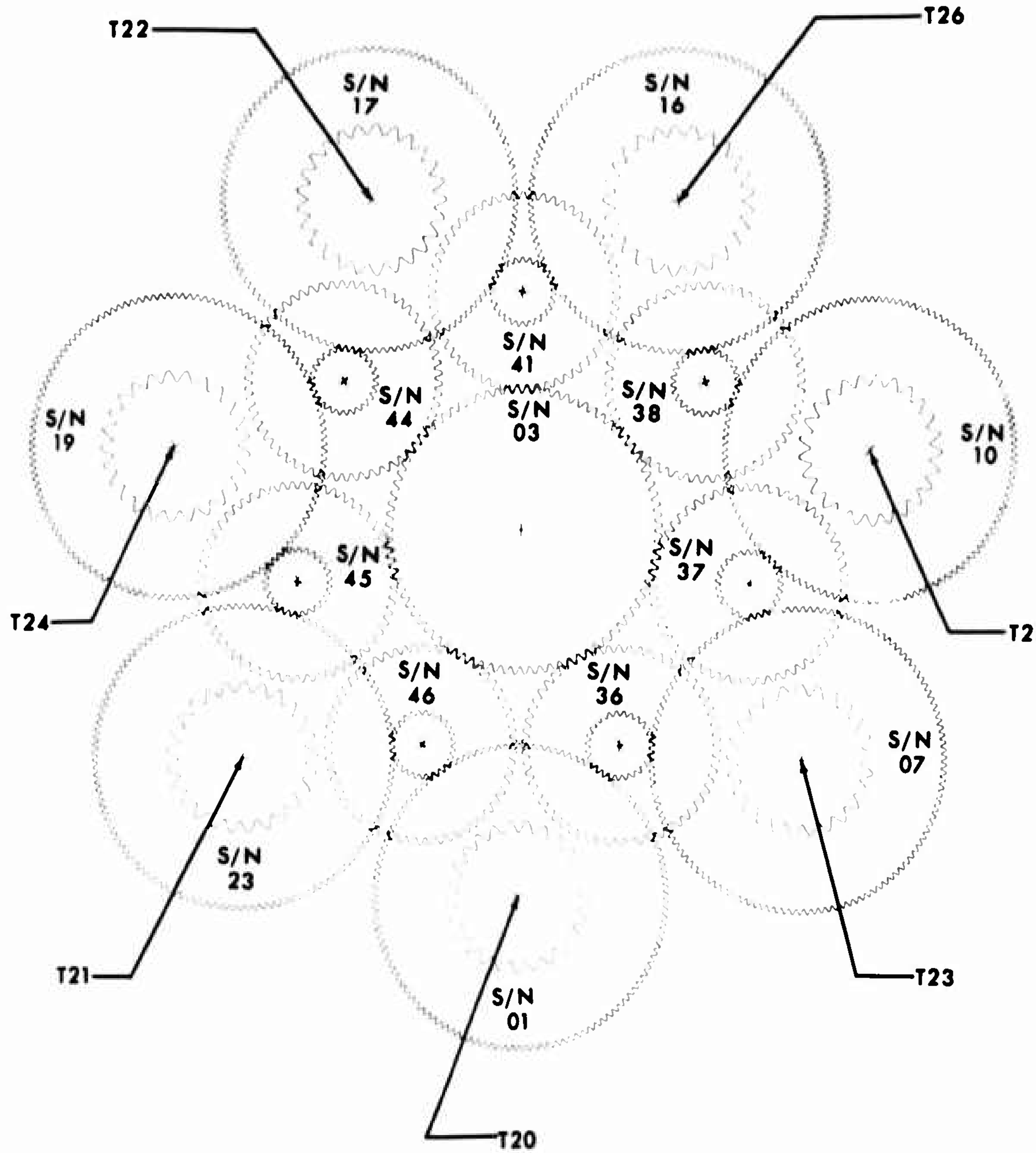


Figure 106. Component Location - Dummy Roller Gear Unit.

TABLE XV. ENDURANCE TEST - 110-HOUR SPECTRUM		
Time (hr:min)	Total Input Power (hp)	Tail Power (hp)
15:00	1100	250
50:00	1950	250
25:00	2400	250
10:00	2700	250
6:30	3000	425
1:30	1950	425
1:30	3560	425
:30	3700	425

TABLE XVI. ENDURANCE TEST - 40-HOUR SPECTRUM		
Time (hr:min)	Total Input Power (hp)	Tail Power (hp)
4:00	1100	250
10:15	1950	250
4:45	1950	425
4:00	2400	250
2:30	2700	250
11:45	3000	425
1:45	3560	425
1:00	3700	425

TABLE XVII. ENDURANCE TEST - 50-HOUR SPECTRUM		
Time (hr:min)	Total Input Power (hp)	Tail Power (hp)
0:45	400	40
3:30	1100	250
21:30	1950	250
8:30	2400	250
4:30	2700	250
7:45	3000	425
2:45	3560	425
0:45	3700	425

Figure 107. Spalled Ball Bearing - Adaptor Gearbox.

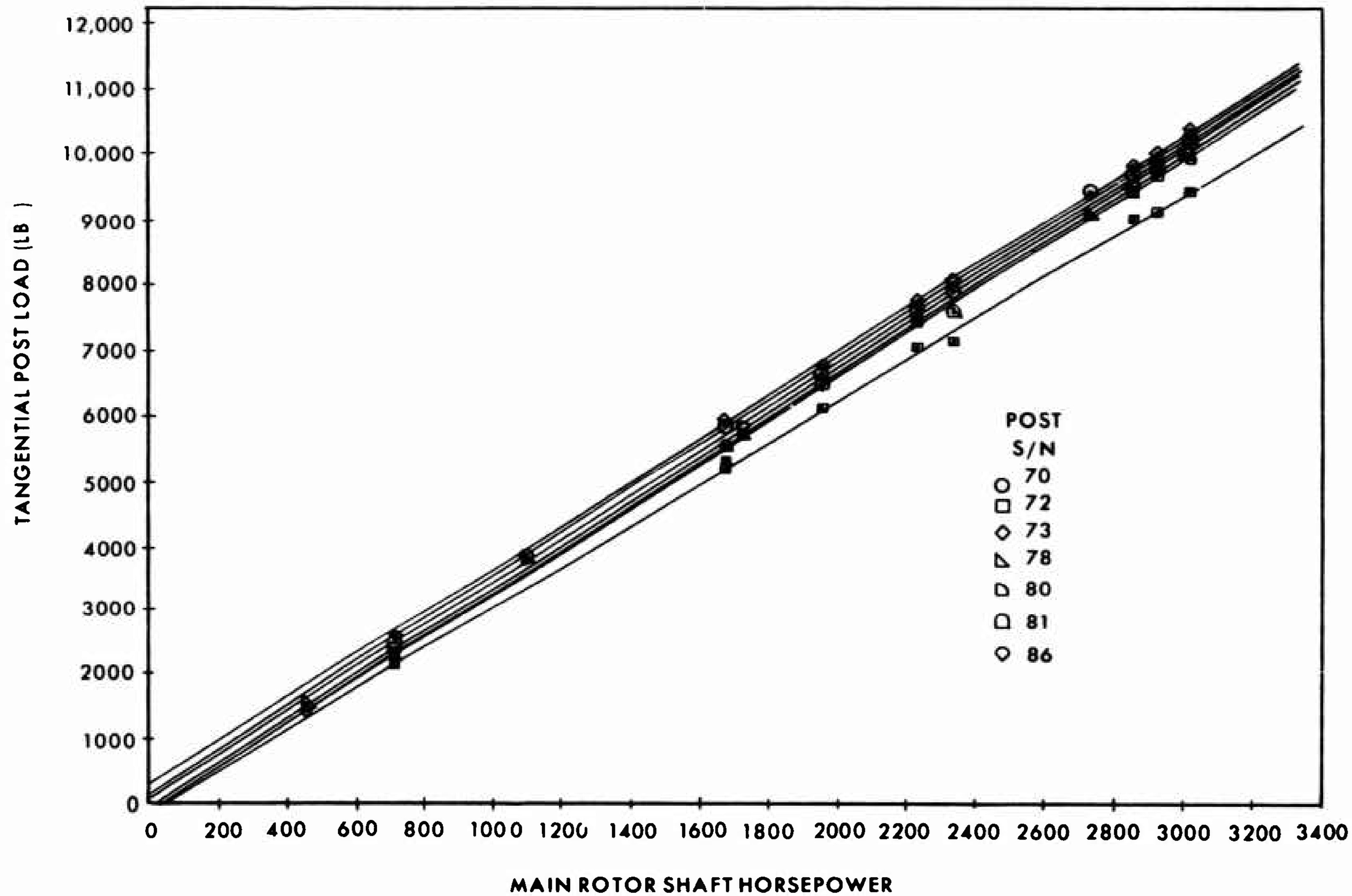


Figure 108. Tangential Post Load Versus Main Rotor Shaft Horsepower.

TABLE XVIII. 200-HOUR INSPECTION, TEST GEARB
MAIN TRANSMISSION

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGL INSPE
RG351-11183-041	Sun Gear	09	220.9	Rollers excellent (Parco finish is on rollers and shoulders). Gear teeth excellent. Internal spline shows slight fretting.	No indi
RG351-11182-062	1st-Row Pinion	33	200.0	Gear teeth excellent. Lower inner roller exhibits surface flaking 1/8" from edge.	No indi
RG351-11182-062	1st-Row Pinion	35	200.0	Rollers and gear teeth excellent.	No indi
RG351-11182-062	1st-Row Pinion	39	200.0	Rollers and gear teeth excellent.	No indi
RG351-11182-062	1st-Row Pinion	42	200.0	Rollers and gear teeth excellent.	No indi
RG351-11182-062	1st-Row Pinion	43	200.0	Rollers and gear teeth excellent.	No indi
RG351-11182-062	1st-Row Pinion	48	200.0	Rollers and gear teeth excellent. Upper roller surface is not polished.	No indi
RG351-11182-062	1st-Row Pinion	49	200.0	Gear teeth excellent. Slight line on upper roller edge.	No indi
RG351-11181-062	2nd-Row Pinion	29	200.0	Gear teeth and rollers excellent. Parco finish on upper roller slightly removed.	Crack indica around insid bore.

XVIII. 200-HOUR INSPECTION, TEST GEARBOX
MAIN TRANSMISSION

TAL ST ME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
0.9	Rollers excellent (Parco finish is on rollers and shoulders). Gear teeth excellent. Internal spline shows slight fretting.	No indications	-
).0	Gear teeth excellent. Lower inner roller exhibits surface flaking 1/8" from edge.	No indications	Spalling of roller surface .00015 deep, caused by insufficient crown blending on mating roller.
).0	Rollers and gear teeth excellent.	No indications	-
.0	Rollers and gear teeth excellent.	No indications	-
.0	Rollers and gear teeth excellent.	No indications	-
.0	Rollers and gear teeth excellent.	No indications	-
.0	Rollers and gear teeth excellent. Upper roller surface is not polished.	No indications	Indication of pure rolling.
.0	Gear teeth excellent. Slight line on upper roller edge.	No indications	Insufficient crown blending on mating roller.
.0	Gear teeth and rollers excellent. Parco finish on upper roller slightly removed.	Crack indication around inside bearing bore.	Crack originating from EB weld voids.

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/Z INSPECTIO
RG351-11181-062	2nd-Row Pinion	38	200.0	Rollers and gear teeth excellent.	Crack indication around inside be bore.
RG351-11181-062	2nd-Row Pinion	48	200.0	Rollers and gear teeth excellent. Slight fretting at flange interface holes.	Crack indication around inside be bore.
RG351-11181-062	2nd-Row Pinion	49	200.0	Rollers and gear teeth excellent. Slight fretting at flange interface holes.	Crack indication around inside be bore and on top
RG351-11181-062	2nd-Row Pinion	53	200.0	Rollers and gear teeth excellent. Slight fretting at flange interface holes.	No indicatic
RG351-11181-062	2nd-Row Pinion	57	200.0	Rollers and gear teeth excellent. Slight fretting at flange interface holes.	No indicatic
RG351-11181-062	2nd-Row Pinion	58	200.0	Rollers and gear teeth excellent. Slight fretting at flange interface holes.	No indicatic
RG351-11185-103	Hub	04	256.9	Internal spline in excellent condition.	No indicatic
RG351-11185-041	Plate Ass'y	06	256.9	Excellent	No indicatic
RG351-11176-041	Plate Ass'y	06	256.9	Light fretting about post interface.	No indicatic

TABLE XVIII - Continued

OTAL EST IME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
00.0	Rollers and gear teeth excellent.	Crack indication around inside bearing bore.	Crack originating from EB weld voids.
)0.0	Rollers and gear teeth excellent. Slight fretting at flange interface holes.	Crack indication around inside bearing bore.	Crack originating from EB weld voids.
)0.0	Rollers and gear teeth excellent. Slight fretting at flange interface holes.	Crack indications around inside bearing bore and on top roller.	Crack originating from EB weld voids.
)0.0	Rollers and gear teeth excellent. Slight fretting at flange interface holes.	No indications	-
0.0	Rollers and gear teeth excellent. Slight fretting at flange interface holes.	No indications	-
0.0	Rollers and gear teeth excellent. Slight fretting at flange interface holes.	No indications	-
6.9	Internal spline in excellent condition.	No indications	-
6.9	Excellent	No indications	-
6.9	Light fretting about post interface.	No indications	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYG INSPECTION
RG351-11187-101	Splined Plate	03	256.9	7 teeth located symmetrically exhibit full face loading.	No indicatior
RG351-11173-101	Nut	-	-	Excellent	No indicatio
RG351-11173-101	Nut	-	-	Excellent	No indicatio
RG351-11173-101	Nut	-	-	Excellent	No indicatio
RG351-11173-101	Nut	-	-	Excellent	No indicatio
RG351-11173-101	Nut	-	-	Excellent	No indicatio
RG351-11173-101	Nut	-	-	Excellent	No indicatio
RG351-11173-101	Nut	-	-	Excellent	No indicatio
RG351-11189-101	Oil Pump Gear	04	256.9	Gear pattern excellent.	No indicatio
RG351-11186-041	Plate Ass'y	06	256.9	Excellent	No indicatio
RG351-11177-101	Post	70	256.9	Excellent	No indicatio
RG351-11177-101	Post	72	256.9	Excellent	No indicatio
RG351-11177-101	Post	73	256.9	Excellent	No indicatio
RG351-11177-101	Post	78	256.9	Excellent	No indicatic
RG351-11177-101	Post	80	256.9	Excellent	No indicatic
RG351-11177-101	Post	81	256.9	Excellent	No indicatic
RG351-11177-101	Post	86	256.9	Excellent	No indicatic

TABLE XVIII - Continued

TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
256.9	7 teeth located symmetrically exhibit full face loading.	No indications	Reaction torque deflections. No significant wear.
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
256.9	Gear pattern excellent.	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGI INSPECTION
RG351-11184-041	Ring Gear	02	256.9	Gear teeth excellent	No indications
22313 VAG	Spherical Brg.	N4	220.9	Excellent	No indications
22313 VAG	Spherical Brg.	N12	220.9	Excellent	No indications
22313 VAG	Spherical Brg.	N17	220.9	Excellent	No indications
22313 VAG	Spherical Brg.	N20	220.9	Excellent	No indications
22313 VAG	Spherical Brg.	N29	220.9	Excellent	No indications
22313 VAG	Spherical Brg.	N35	220.9	Excellent	No indications
22313 VAG	Spherical Brg.	N36	220.9	Excellent	No indications
RG351-11179-101	Spacer	-	200.0	Face worn .002 - .007	No indications
RG351-11179-101	Spacer	-	200.0	Face worn .002 - .007	No indications
RG351-11179-101	Spacer	-	200.0	Face worn .002 - .007	No indications
RG351-11179-101	Spacer	-	200.0	Face worn .002 - .007	No indications
RG351-11179-101	Spacer	-	200.0	Face worn .002 - .007	No indications

TABLE XVIII - Continued

TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
256.9	Gear teeth excellent	No indications	Excellent gear teeth patterns.
220.9	Excellent	No indications	-
220.9	Excellent	No indications	-
220.9	Excellent	No indications	-
220.9	Excellent	No indications	-
220.9	Excellent	No indications	-
220.9	Excellent	No indications	-
220.9	Excellent	No indications	-
200.0	Face worn .002 - .007	No indications	Wear due to working of 2nd row gear/flange assembly.
200.0	Face worn .002 - .007	No indications	Wear due to working of 2nd row gear/flange assembly.
200.0	Face worn .002 - .007	No indications	Wear due to working of 2nd row gear/flange assembly.
200.0	Face worn .002 - .007	No indications	Wear due to working of 2nd row gear/flange assembly.
200.0	Face worn .002 - .007	No indications	Wear due to working of 2nd row gear/flange assembly.

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW INSPECT
RG351-11179-101	Spacer	-	200.0	Face worn .002 - .007	No indica
RG351-11179-101	Spacer	-	200.0	Face worn .002 - .007	No indica
RG351-11160-042	Main Rotor Shaft	-	-	Excellent	No indica
525519	Seal	-	-	-	-
R1838-C-400	Roller Brg	-	-	-	-
RG351-11154-101	Spur Gear	06	-	Excellent	No indica
CB63-4	Seal	-	-	-	-
SB1357-2	Ball Brg.	-	-	-	-
RG351-11194-101	Quill Shaft	03	-	Fretting at both ends	No indica
RG351-11205-101	Quill Shaft	03	-	Fretting at large external spline.	No indica
S6135-20713-1	Nut	61	-	Excellent	No indica
S6135-20713-1	Nut	62	-	Excellent	No indica
RG351-11256-101	Gear	06	-	Slight pitting on gear teeth.	No indica

TABLE XVIII - Continued

OTAL EST IME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
00.0	Face worn .002 - .007	No indications	Wear due to working of 2nd row gear/flange assembly.
00.0	Face worn .002 - .007	No indications	Wear due to working of 2nd row gear/flange assembly.
-	Excellent	No indications	-
-	-	-	-
-	-	-	-
-	Excellent	No indications	-
-	-	-	-
-	-	-	-
-	Fretting at both ends	No indications	More lubricant required
-	Fretting at large external spline.	No indications	Lubrication needs adjusting.
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Slight pitting on gear teeth.	No indications	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZY INSPECTION
RG351-11113-101	Input Bevel	06	256.9	Excellent	No indicatio
MM212VM9-SMBR-A 1584	Stack Brgs	108	256.9	Excellent	-
SB2154-1	Roller Brg.	121	256.9	Slightly ratchety.	-
RG351-11117-102	Nut	-	-	Excellent	No indicatio
RG351-11117-101	Nut	-	-	Excellent	No indicatio
RG351-11113-101	Input Bevel	04	256.9	Slight score marks on teeth. Pattern excellent.	No indicatio
MM212VM9-SMBR-A1584	Stack Brgs.	100	256.9	Excellent	-
SB2154-1	Roller Brg.	131	256.9	Slightly ratchety.	-
RG351-11117-102	Nut	-	-	Excellent	No indicatic
RG351-11117-101	Nut	-	-	Excellent	No indicatic
RG351-11117-103	Nut	-	-	Excellent	No indicatic
111-KS-400	Bearing	-	256.9	Excellent	-

TABLE XVIII - Continued

TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
256.9	Excellent	No indications	Dynamic gear teeth patterns excellent.
256.9	Excellent	-	-
256.9	Slightly ratchety.	-	Ultrasonically cleansed
-	Excellent	No indications	-
-	Excellent	No indications	-
256.9	Slight score marks on teeth. Pattern excel-lent.	No indications	Dynamic gear teeth patterns excellent.
256.9	Excellent	-	-
256.9	Slightly ratchety.	-	Ultrasonically cleansed
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
256.9	Excellent	-	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ INSPECTI
NAS 1493-14	Nut	-	-	Excellent	No indicat
RG351-11146-101	Quill Shaft	01	-	Int. spline shows slight fretting.	No indicat
RG351-11139-102	Bushing	-	-	Excellent	-
1838-JD-400-B	Ball Brg.	E12	256.9	Excellent	-
RG351-11109-102	Nut	-	-	Excellent	No indicat
RG351-11136-101	Pin (2 pcs)	-	-	Excellent	-
RG351-11135-101	Cage	09	256.9	Slight wear at slot edges.	No indicat
RG351-11133-041	Cam	10	-	Non-uniform Parco removal on flats.	No indicat
RG351-11117-104	Nut	-	-	Excellent	No indicat
SB2157-2	Roller Brg.	386B	-	Excellent	-
RG351-11131-101	Spur Shaft	14	256.9	Slight fretting about holes in mounting flange.	No indica
RG351-11132-101	Spur Gear	02	256.9	Slight fretting about mounting holes in flange.	No indica

TABLE XVIII - Continued

OTAL EST IME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
-	Excellent	No indications	-
-	Int. spline shows slight fretting.	No indications	Requires improved lubrication.
-	Excellent	-	-
6.9	Excellent	-	-
-	Excellent	No indications	-
-	Excellent	-	-
6.9	Slight wear at slot edges.	No indications	Normal wearing-in
-	Non-uniform Parco removal on flats.	No indications	No surface indentations
-	Excellent	No indications	-
-	Excellent	-	-
.9	Slight fretting about holes in mounting flange.	No indications	-
.9	Slight fretting about mounting holes in flange.	No indications	Gear pattern excellent

TABL☐ XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZY INSPECTION
RG351-11139-101	Bushing	-	-	Excellent	-
X3762	Roller (14 pcs)	-	221.0	Excellent	No indicatio
RG351-11128-101	Bevel Gear	10	256.9	Excellent	No indicatio
RG351-11129-101	Bevel Shaft	01	256.9	Int. spline shows slight fretting.	No indicatio
SB 1056-2	Duplex Ball Bearing	1842	-	Excellent	No indicatio
RG351-11134-101	Cam Housing	89	256.9	Slight fretting on ext. spline.	No indicatio
RG351-11143-101	Nut	-	-	Excellent	No indicatio
MR-1922-C-400	Roller Brg.	19	256.9	Excellent	-
RG351-11126-041	Housing	006	-	Excellent	-
RG351-11109-101	Nut	-	-	Excellent	No indicatior
RG351-11117-103	Nut	-	-	Excellent	No indicatior
111-KS-400	Bearing	-	256.9	Excellent	-

TABLE XVIII - Continued

L	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
	Excellent	-	-
.0	Excellent	No indications	Excellent condition
.9	Excellent	No indications	Excellent gear teeth patterns.
.9	Int. spline shows slight fretting.	No indications	Requires improved lubrication.
	Excellent	No indications	-
.9	Slight fretting on ext. spline.	No indications	Requires improved lubrication.
	Excellent	No indications	-
.9	Excellent	-	-
	Excellent	-	-
	Excellent	No indications	-
	Excellent	No indications	-
.9	Excellent	-	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYG INSPECTION
NAS 1493-14	Nut	-	-	Excellent	No indication
RG351-11146-101	Quill Shaft	05	256.9	Ext. spline excessive fretting. Int. spline has slight fretting.	No indication
RG351-11139-101	Bushing	-	-	Excellent	-
1838-JD-400-B	Ball Brg.	E12	256.9	Outer race edge has pit marks.	No indications
RG351-11109-102	Nut	-	-	Excellent	No indications
RG351-11136-101	Pin (2 pcs)	-	-	Excellent	-
RG351-11135-101	Cage	06	-	Slight wear at slot end	No indications
RG351-11133-041	Cam	03	-	Parco finish removed on flats.	No indications
RG351-11117-104	Nut	-	-	Excellent	No indications
SB2157-2	Roller Brg.	429B	256.9	Slight fretting on O.D.	-
RG351-11131-101	Spur Shaft	10	-	Fretting around flange holes.	No indications

TABLE XVIII - Continued

TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
-	Excellent	No indications	-
256.9	Ext. spline excessive fretting. Int. spline has slight fretting.	No indications	Requires improved lubrication.
-	Excellent	-	-
256.9	Outer race edge has pit marks.	No indications	Possibly insufficient clamp up pressure.
-	Excellent	No indications	-
-	Excellent	-	-
-	Slight wear at slot end	No indications	-
-	Parco finish removed on flats.	No indications	No surface indentation
-	Excellent	No indications	-
256.9	Slight fretting on O.D.	-	Localized fretting in area of oil drainage slot in housing.
-	Fretting around flange holes.	No indications	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ INSPECTI
RG351-11132-101	Spur Gear	10	256.9	Fretting around mounting holes. Gear teeth excellent.	-
RG351-11139-101	Bushing	-	-	Excellent	-
X3762	Roller (14 pcs)	-	-	Excellent	No indicat
RG351-11128-101	Bevel Gear	07	256.9	Excellent	No indicat
RG351-11129-101	Bevel Shaft	03	-	Int. spline fretted with excessive oxidation residue.	No indicat
SB1056-2	Duplex Brg.	1822	256.9	Excellent	-
RG351-11134-101	Cam Hsg	82	-	Excellent	No indicat
RG351-11143-101	Nut	-	-	Excellent	No indicat
MR-1922-C-400	Roller Brg.	21	256.9	Excellent	-
RG351-11126-041	Housing	01	-	Excellent	No indica
RG351-11109-101	Nut	-	-	Excellent	No indica

TABLE XVIII - Continued

R.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
)	256.9	Fretting around mounting holes. Gear teeth excellent.	-	-
	-	Excellent	-	-
	-	Excellent	No indications	-
'	256.9	Excellent	No indications	Dynamic teeth patterns excellent.
;	-	Int. spline fretted with excessive oxidation residue.	No indications	Requires improved lubrication
2	256.9	Excellent	-	-
:	-	Excellent	No indications	-
	-	Excellent	No indications	-
.	256.9	Excellent	-	-
.	-	Excellent	No indications	-
	-	Excellent	No indications	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYG INSPECTION
RG351-11193-101	Bevel Gear	1	-	Small nick 2/3 along face (one tooth).	No indicatior
34306 34478	Timken Brg. Timken Brg.	-	-	Excellent	-
RG351-11266-041	Oil Tube	-	-	Excellent	-
RG351-11191-041	Housing	05	-	Excellent	No indicatio
SB3253A-1 SB3253B-1	Timken Brg. Timken Brg.	-	-	Excellent	-
RG351-11117-105	Nut	-	-	Excellent	No indicatio
RG351-11248-101	Spacer	-	-	Excellent	No indicatio
RG351-11157-101	Quill Shaft	03	-	Slight fretting at both external splines.	No indicatio
RG351-11156-102	Clip	-	-	Excellent	No indicatio
RG351-11178-101	Nut	-	-	Excellent	No indicatio
RG351-11151-041	Hsg. Ass'y	04	-	Excellent	No indicatio

TABLE XVIII - Continued

t.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
	-	Small nick 2/3 along face (one tooth).	No indications	This nick caused a slight impression in the mating gear RG351-11155-101. Nick was probably caused by mishandling.
	-	Excellent	-	-
	-	Excellent	-	-
	-	Excellent	No indications	-
	-	Excellent	-	-
	-	Excellent	No indications	-
	-	Excellent	No indications	-
	-	Slight fretting at both external splines.	No indications	Requires more lubricant.
	-	Excellent	No indications	-
	-	Excellent	No indications	-
	-	Excellent	No indications	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/Z INSPECTIO
RG351-11155-101	Bevel Gear	04	-	Gear pattern has an impression 1/3 from O.D. on each tooth.	No indicati
SB3602B-1 SB3602A-1	Timken Brg. LL639210	-	-	Excellent	-
RG351-11137-101	Spacer	-	-	-	No indicati
RG351-11153-101	Outer Shaft	02	-	Internal spline fretting	No indicati
MR-1840-C-400	Roller Brg.	E9	-	Outer race O.D. shows slight fretting in one place.	-
RG351-11109-103	Nut	-	-	Excellent	No indicati
RG351-11212-101	Spur Gear	01	-	Excellent	No indicati
SB2102-1	Roller Brg.	3350	-	Excellent	-
SB1106-1	Ball Brg.	-	-	Excellent	-
B-107716	Seal	-	-	Excellent	-
S6135-20053-3	Nut	-	-	Excellent	No indicat
RG351-11211-101	Spur Gear	02	-	Excellent	No indicat

TABLE XVIII - Continued

.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
	-	Gear pattern has an impression 1/3 from O.D. on each tooth.	No indications	This was caused by a nick in the mating pinion RG351-11193-101.
	-	Excellent	-	-
	-	-	No indications	-
	-	Internal spline fretting	No indications	Requires improved lubrication.
	-	Outer race O.D. shows slight fretting in one place.	-	Localized fretting in area of oil drainage slot in housing.
	-	Excellent	No indications	-
	-	Excellent	No indications	-
	-	Excellent	-	-
	-	Excellent	-	-
	-	Excellent	-	-
	-	Excellent	No indications	-
	-	Excellent	No indications	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZY INSPECTION
SB2102-1	Roller Brg.	3283	-	Excellent	-
SB1106-1	Ball Brg.	-	-	Excellent	-
B-107716	Seal	-	-	Excellent	-
S6135-20053-3	Nut	-	-	Excellent	No indicatio
RG351-11223-101	Gear Shaft	05	-	Excellent	No indicatio
SB2100-2	Roller Brg	121	-	Excellent	-
RG351-11222-101	Gear	07	-	Excellent	No indicatio
RG351-11197-101	Gear	01	-	Excellent	No indicatio
NAS 1493-12	Nut	-	-	Excellent	No indicatio
SB1157-1	Ball Brg.	-	-	Excellent	-
NAS 1493-13	Nut	-	-	Excellent	No indicatio
RG351-11196-101	Gear	02	-	Excellent	No indicatio
RG351-11209-101	Gear	01	-	Excellent	No indicatio
HU1013EAR5612	Roller Br.	12	-	Excellent	No indicatio

TABLE XVIII - Continued

TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
-	Excellent	-	-
-	Excellent	-	-
-	Excellent	-	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	-	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	-	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZY INSPECTION
NAS 1493-14	Nut	-	-	Excellent	No indicatic
208-S-400	Ball Brg.	-	-	Excellent	-
515836	Seal	-	-	Excellent	-
65351-11231-102	Flange	-	-	Excellent	No indicati
RG351-11220-101	Gear	05	-	Excellent	No indicati
SB1131-102	Duplex Ball Brgs.	19	-	Excellent	-
508863	Seal	-	-	Excellent	-
S6135-20348-0	Flange	71	-	Excellent	No indicat:
S6135-20031-1	Nut	-	-	Excellent	No indicat:
RG351-11219-101	Gear	01	-	Excellent	No indicat
SB1100-3(2)	Ball Brg.	-	-	Excellent	-
S6135-20075-0	Shaft Quill	-	-	Excellent	No indicat
CB67-4	Seal	-	-	Excellent	-

TABLE XVIII - Continued

TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
-	Excellent	No indications	-
-	Excellent	-	-
-	Excellent	-	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	-	-
-	Excellent	-	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	-	-
-	Excellent	No indications	-
-	Excellent	-	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZY INSPECTION
6435-20047-100	Nut	-	-	Excellent	No indicatio
SS5075-15	-	-	-	Tangs broke off.	-
R6351-11213-101	Gear	05	-	Excellent	No indicatio
SB2102-1	Roller Brg.	3340	-	Excellent	-
SB1105-1	Ball Brg.	-	-	Excellent	-
CB66-4	Seal	-	-	Excellent	-
S6135-20053-2	Nut	-	-	Excellent	No indicatior
S6135-20181-2	Gear	703	-	Excellent	No indicatior
SB2102-1	Roller Brg.	-	-	Excellent	-
SB1105-1	Ball Brg.	-	-	Excellent	-
CB66-4	Seal	-	-	Excellent	-
S6135-20053-2	Nut	-	-	Excellent	No indication
S6135-20181-2	Gear	699	-	Slight debris damage	No indication

TABLE XVIII - Continued

VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
Excellent	No indications	This nut was used in place of NAS1493-9
Tangs broke off.	-	SS5075-15 was used in place of NAS1443-9.
Excellent	No indications	-
Excellent	-	-
Excellent	-	-
Excellent	-	-
Excellent	No indications	-
Excellent	No indications	-
Excellent	-	-
Excellent	-	-
Excellent	-	-
Excellent	No indications	-
Slight debris damage	No indications	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYG INSPECTION
SB2102-1	Roller Brg.	3352	-	Excellent	-
SB1105-1	Ball Brg	-	-	Excellent	-
CB66-4	Seal	-	-	Excellent	-
S6135-20053-2	Nut	-	-	Excellent	No indication
RG351-11233-101	Oil Pump	B 1174	-	Excessive fretting at internal square drive.	-
RG351-11218-041	Elbow Ass'y	007	-	Excellent	-
S6135-20053-5	Nut	-	-	Excellent	No indication
SB1104-3	Ball Brg.	-	-	Excellent	-
RG351-11216-101	Spacer	13	-	Excellent	No indication
SB2102-1	Roller Brg.	3301	-	Excellent	-
RG351-11214-101	Gear	05	-	Slight debris damage on drive side of gear.	No indication
RG351-11215-101	Quill Shaft	-	-	Fretting on external square drive.	No indication
NAS1493-12	Nut	-	-	Excellent	No indication

TABLE XVIII - Continued

TAL ST ME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
-	Excellent	-	-
-	Excellent	-	-
-	Excellent	-	-
-	Excellent	No indications	-
-	Excessive fretting at internal square drive.	-	Insufficient lubrication.
-	Excellent	-	-
-	Excellent	No indications	-
-	Excellent	-	-
-	Excellent	No indications	-
-	Excellent	-	-
-	Slight debris damage on drive side of gear.	No indications	-
-	Fretting on external square drive.	No indications	Insufficient lubrication.
-	Excellent	No indications	-

TABLE XVIII - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ INSPECTI
M211KMBRA1590	Ball Brg.	-	-	Excellent	-
RG351-11251-101	Gear	02	-	Slight pitting on gear teeth.	No indicat
SB1159-1	Ball Brg.	-	-	Excellent	-
NAS1493-10	Nut	-	-	Excellent	No indicat
NAS1493-12	Nut	-	-	Excellent	No indicat
M211KMBRA1590	Ball Brg	-	-	Excellent	-
NAS1493-12	Nut	-	-	Excellent	No indica
NAS1493-10	Nut	-	-	Excellent	No indica
SB1159-1	Ball Brg.	-	-	Excellent	-
RG351-11257-101	Gear	06	-	Slight pitting on gear teeth; external spline shows slight wear pattern.	No indica
HU-1012-LAR-3514	Roller Brg	3	-	Excellent	-
CB81-23	Seal	-	-	Excellent	-
S6137-23067-1	Flange	-	-	Excellent	No indica

TABLE XVIII - Continued

SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
-	-	Excellent	-	-
02	-	Slight pitting on gear teeth.	No indications	-
-	-	Excellent	-	-
-	-	Excellent	No indications	-
-	-	Excellent	No indications	-
-	-	Excellent	-	-
-	-	Excellent	No indications	-
-	-	Excellent	No indications	-
-	-	Excellent	-	-
06	-	Slight pitting on gear teeth; external spline shows slight wear pattern.	No indications	-
3	-	Excellent	-	-
-	-	Excellent	-	-
-	-	Excellent	No indications	-

TABLE XVIII - Continued					
PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYG INSPECTION
S6137-23047-3	Nut	-	-	Excellent	No indicatio
S6135-22072-1	Coupling	-	-	Excellent	No indicatio
S6135-22072-1	Coupling	-	-	Excellent	No indicatio

TABLE XVIII - Continued

TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-

TABLE XIX. 200-HOUR INSPECTION DUMMY GEARBOX
ROLLER GEAR UNIT

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/Z INSPECTIC
RG351-11183-041	Sun Gear	03	230.4	Slight debris damage in both rollers and gear teeth.	No indicati
RG351-11182-062	1st-Row Pinion	36	200.0	Rollers and gear teeth excellent.	No indicati
RG351-11182-062	1st-Row Pinion	37	200.0	Rollers and gear teeth excellent.	No indicati
RG351-11182-062	1st-Row Pinion	38	200.0	Small lower roller not polished. Other rollers and gears excellent.	No indicati
RG351-11182-062	1st-Row Pinion	41	200.0	Small rollers are not polished. Other rollers and gears excellent.	No indicati
RG351-11182-062	1st-Row Pinion	44	200.0	Stain on upper small roller. Rollers and gear teeth excellent.	No indicati
RG351-11182-062	1st-Row Pinion	45	200.0	Rollers and gear teeth excellent.	No indicati
RG351-11182-062	1st-Row Pinion	46	200.0	Small rollers are not polished. Small gear has pit marks on gear flank near root.	No indicati
RG351-11181-062	2nd-Row Pinion	01	247.4	Rollers and gear teeth excellent.	No indicati
RG351-11181-062	2nd-Row Pinion	07	220.9	Rollers and gear teeth excellent.	No indicati
RG351-11181-062	2nd-Row Pinion	10	247.4	Rollers and gear teeth excellent.	Upper gear flang an indication.

TABLE XIX. 200-HOUR INSPECTION DUMMY GEARBOX ROLLER GEAR UNIT

R. .	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
3	230.4	Slight debris damage in both rollers and gear teeth.	No indications	-
6	200.0	Rollers and gear teeth excellent.	No indications	-
7	200.0	Rollers and gear teeth excellent.	No indications	-
8	200.0	Small lower roller not polished. Other rollers and gears excellent.	No indications	-
1	200.0	Small rollers are not polished. Other rollers and gears excellent.	No indications	-
1	200.0	Stain on upper small roller. Rollers and gear teeth excellent.	No indications	-
	200.0	Rollers and gear teeth excellent.	No indications	-
	200.0	Small rollers are not polished. Small gear has pit marks on gear flank near root.	No indications	-
	247.4	Rollers and gear teeth excellent.	No indications	-
	220.9	Rollers and gear teeth excellent.	No indications	-
	247.4	Rollers and gear teeth excellent.	Upper gear flange shows an indication.	Radial crack originating from EB weld.

TABLE XIX - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYG INSPECTION
RG351-11181-062	2nd-Row Pinion	16	247.4	Rollers and gear teeth excellent. Metallic particles inside bore.	Upper gear flange shows an indicatic
RG351-11181-062	2nd-Row Pinion	17	247.4	Rollers and gear teeth excellent.	No indicatior
RG351-11181-062	2nd-Row Pinion	19	247.4	Rollers and gear teeth excellent.	Upper gear flange shows an indicatic
RG351-11181-062	2nd-Row pinion	23	247.4	Large gear shows pitting 6 teeth. Rollers and small gear excellent.	No indicatior
RG351-11585-103	Hub	05	-	Excellent	No indicatior
RG351-11585-041	Plate Ass'y	04	-	Excellent	No indicatior
RG351-11176-041	Plate Ass'y	-	-	Excellent	No indicatior
RG351-11187-101	Splined Plate	01	-	7 groups of 7 teeth located symmetrically exhibit full face loading. Location mid-way between posts.	No indicatior
RG351-11173-101	Nut	-	-	Excellent	No indicatior
RG351-11173-101	Nut	-	-	Excellent	No indicatior
RG351-11173-101	Nut	-	-	Excellent	No indicatior
RG351-11173-101	Nut	-	-	Excellent	No indicatior

TABLE XIX - Continued

TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
247.4	Rollers and gear teeth excellent. Metallic particles inside bore.	Upper gear flange shows an indication.	Radial crack originating from EB weld.
247.4	Rollers and gear teeth excellent.	No indications	-
247.4	Rollers and gear teeth excellent.	Upper gear flange shows an indication.	Radial crack originating from EB weld.
247.4	Large gear shows pitting 6 teeth. Rollers and small gear excellent.	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	7 groups of 7 teeth located symmetrically exhibit full face loading. Location mid-way between posts.	No indications	Reaction torque deflections. No significant wear.
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-

TABLE XIX - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZY INSPECTION
RG351-11173-101	Nut	-	-	Excellent	No indicatio
RG351-11173-101	Nut	-	-	Excellent	No indicatio
RG351-11173-101	Nut	-	-	Excellent	No indicatio
RG351-11189-101	Oil Pump Gear	-	-	Excellent	No indicatio
RG351-11186-041	Plate Ass'y	-	-	Excellent	-
RG351-11177-101	Post	74	256.9	Excellent	No indicatio
RG351-11177-101	Post	75	256.9	Excellent	No indicatio
RG351-11177-101	Post	76	256.9	Excellent	No indicatio
RG351-11177-101	Post	83	256.9	Excellent	No indicatio
RG351-11177-101	Post	85	256.9	Excellent	No indicatio
RG351-11177-101	Post	87	256.9	Excellent	No indicatio
RG351-11177-101	Post	89	256.9	Excellent	No indicatio
RG351-11184-041	Ring Gear	04	-	Excellent	No indicatio
22313 VAG	Spherical Brg.	N6	200.9	Slight fretting on end face.	-
22313 VAG	Spherical Brg.	N7	220.9	Excellent	-
22313 VAG	Spherical Brg.	N13	220.9	Slight fretting on end face.	-
22313 VAG	Spherical Brg.	N21	220.9	Excellent	-

TABLE XIX - Continued

TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	No indications	-
-	Excellent	-	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
256.9	Excellent	No indications	-
-	Excellent	No indications	-
00.9	Slight fretting on end face.	-	Due to spacer working
20.9	Excellent	-	-
20.9	Slight fretting on end face.	-	Due to spacer working
20.9	Excellent	-	-

TABLE XIX - Continued

PART NUMBER	NOMENCLATURE	SER. NO.	TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/Z INSPECTIC
22313 VAG	Spherical Brg.	N32	220.9	Excellent	-
22313 VAG	Spherical Brg.	N39	220.9	Excellent	-
22313 VAG	Spherical Brg.	N40	220.9	Excellent	-
RG351-11179-101	Spacer	-	200.0	Faces worn .002 - .007	No indicati
RG351-11179-101	Spacer	-	200.0	Faces worn .002 - .007	No indicati
RG351-11179-101	Spacer	-	200.0	Faces worn .002 - .007	No indicati
RG351-11179-101	Spacer	-	200.0	Faces worn .002 - .007	No indicati
RG351-11179-101	Spacer	-	200.0	Faces worn .002 - .007	No indicati
RG351-11179-101	Spacer	-	200.0	Faces worn .002 - .007	No indicati
RG351-11179-101	Spacer	-	200.0	Faces worn .002 - .007	No indicati

TABLE XIX - Continued

TOTAL TEST TIME	VISUAL INSPECTION	MAGNAGLOW/ZYGLO INSPECTION	COMMENTS
220.9	Excellent	-	-
220.9	Excellent	-	-
220.9	Excellent	-	-
200.0	Faces worn .002 - .007	No indications	Wear due to working of 2nd row gear flange assembly.
200.0	Faces worn .002 - .007	No indications	Wear due to working of 2nd row gear flange assembly.
200.0	Faces worn .002 - .007	No indications	Wear due to working of 2nd row gear flange assembly.
200.0	Faces worn .002 - .007	No indications	Wear due to working of 2nd row gear flange assembly.
200.0	Faces worn .002 - .007	No indications	Wear due to working of 2nd row gear flange assembly.
200.0	Faces worn .002 - .007	No indications	Wear due to working of 2nd row gear flange assembly.
200.0	Faces worn .002 - .007	No indications	Wear due to working of 2nd row gear flange assembly.

Visual Inspection Results

Visual inspection of the roller gear units from the test and dummy gearboxes revealed slight surface flaking on one small roller of first-row pinion, serial number 33, from the test gearbox. This flaking, visible in Figure 109, is approximately 0.00015 inch deep and is caused by incorrect blending of the crown radius on the roller of second-row pinion serial number 29. First-row pinion, serial number 49, also exhibits similar signs of distress though not as pronounced as serial number 33. All other rollers are in excellent condition. Some second-row rollers still retain the phosphate (Parco-Lubrizing) finish, indicating pure rolling contact. The gear teeth on all roller gear components are in excellent condition as are the spherical bearings. The spacers, which clamp the outer races of the second-row spherical bearings, experienced working as a result of the deflections induced on the gear/flange assembly by the ring gear teeth loads. Further evidence of the fatigue loads imposed on this gear/flange assembly is shown in Figure 110 by the fretting around the taper-lock bolt holes.

Both roller gear reaction splined plate assemblies exhibited similar loadings and deflections with full face contact of the mating splines located midway between the second-row pinion posts.

Except for the splined connections on the quill shafts, the remaining components in both gearboxes are in excellent condition. The input and tail takeoff bevel gear patterns are excellent, and the stronger springs installed in the freewheel units successfully presented chucking of the rollers. The quill shaft splines require better lubrication to prevent the fretting oxidation which was occurring. The quill shaft driving the left-hand freewheel unit outer housing, Figure 111, generated excessive amounts of metallic particles as seen in the bevel gear shaft, Figure 112.

Ultrasonic Inspection

The sun gear and first- and second-row pinions from both gearboxes were subjected to the pulse-echo ultrasonic inspection of Appendix II. The ultrasonic recordings obtained were compared to the recordings received when the parts were accepted to determine if there was any degradation of the weld; none could be found.

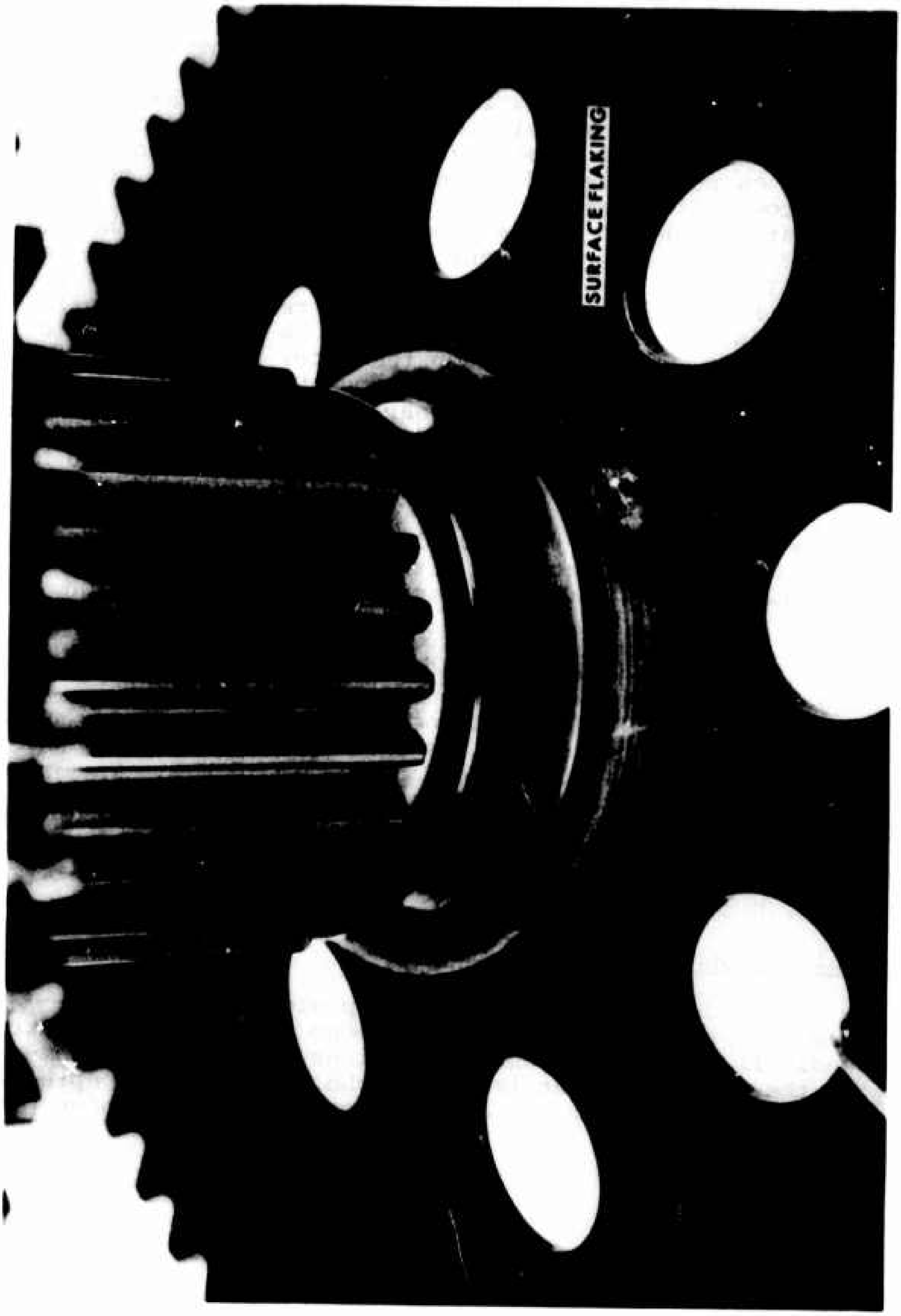


Figure 109. Roller Surface Flaking - First-Row Pinion.

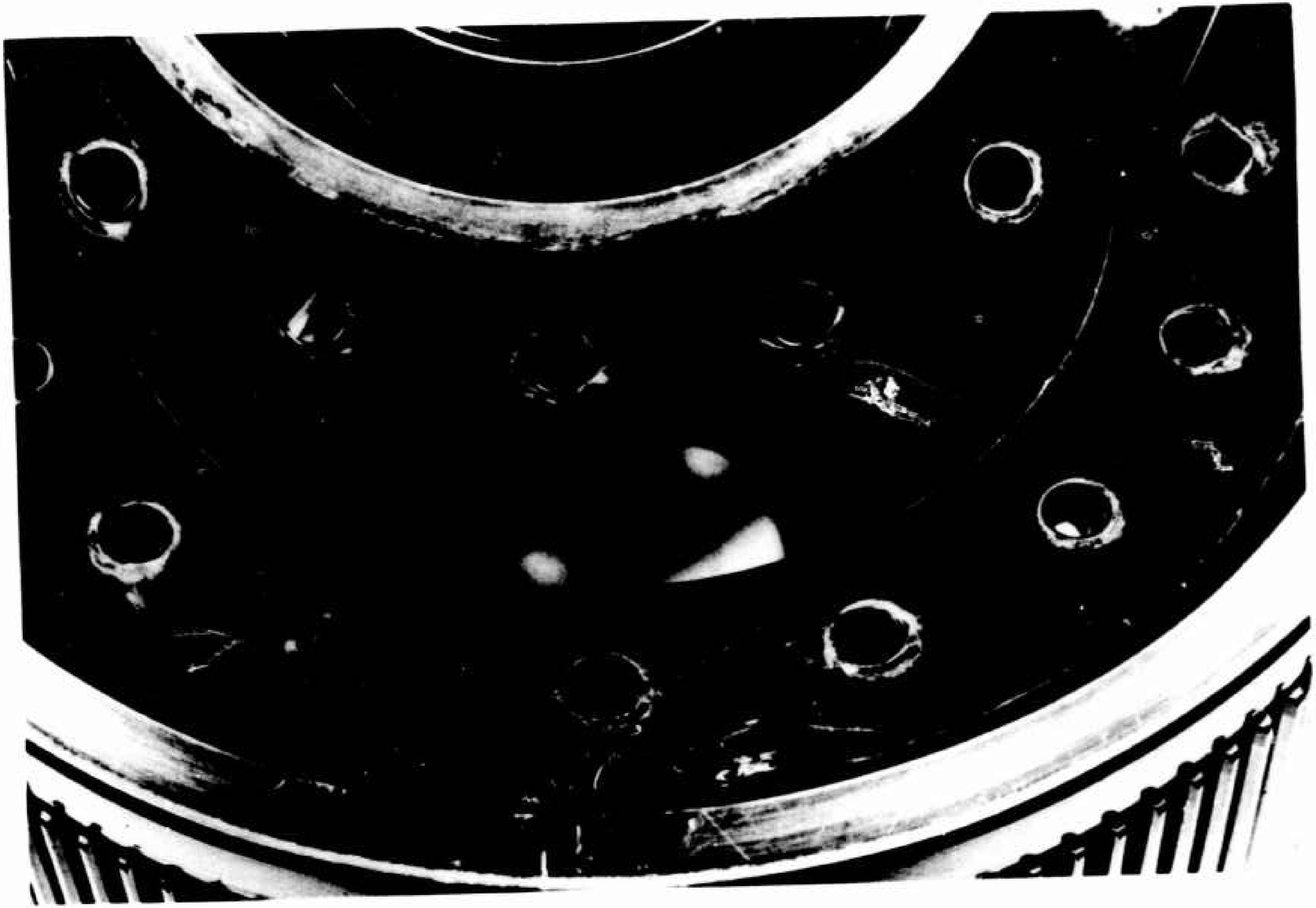


Figure 110. Fretting - Second-Row Pinion, Gear/Flange.

Figure 111. Bevel Gear/Freewheel Housing - Drive Arrangement.

Figure 112. Fretting - Bevel Gear Shaft.

Magnetic Particle Inspection (Magnaglow)

All ferrous components were subjected to fluorescent magnetic particle inspection by the wet continuous method. Indications appeared in the second-row pinions from both gearboxes. The test gearbox second-row pinions, serial numbers 29, 38, 48 and 49, showed circumferential cracks around the bearing bore; also, the roller on serial number 49 witnessed a crack radiating from the roller-gear butt face. The dummy second-row gear/flange assemblies, serial numbers 10, 16 and 19, all showed a single crack radiating from the radius between the gear and flange.

All other ferrous components successfully passed inspection.

Metallurgical Inspection

Sectioning of the second-row pinion, serial number 49, revealed the circumferential crack, indicated by the arrow A in Figure 113, was caused by fatigue cracking originating from multiple voids in the weld root. Figure 114 shows a weld root void penetrating past the butt faces of the gear vertical web and bearing bore shoulder.

The roller crack, indicated by the arrow B in Figure 113, is shown in the black light photograph of Figure 115 and in relation to the weld in Figure 116. Again, this fatigue crack originated from voids in the weld root.

Figure 117 is a view of the radius between the gear and flange of second-row pinion, gear/flange assembly, serial number 16. The crack indicated by the arrow is typical of those witnessed in serial numbers 10 and 19. Visible in Figure 117 is a weld splatter line caused by blow-out of the weld. Metallographic examination revealed a series of voids along the weld line as shown in Figure 118. Separation of the cracked part revealed a fatigue crack, as indicated by the beach marks visible in Figure 119. Microscopic examination revealed the crack originated from a weld void, Figure 120.

It was concluded that these fractures initiated from the voids in the electron beam welds.

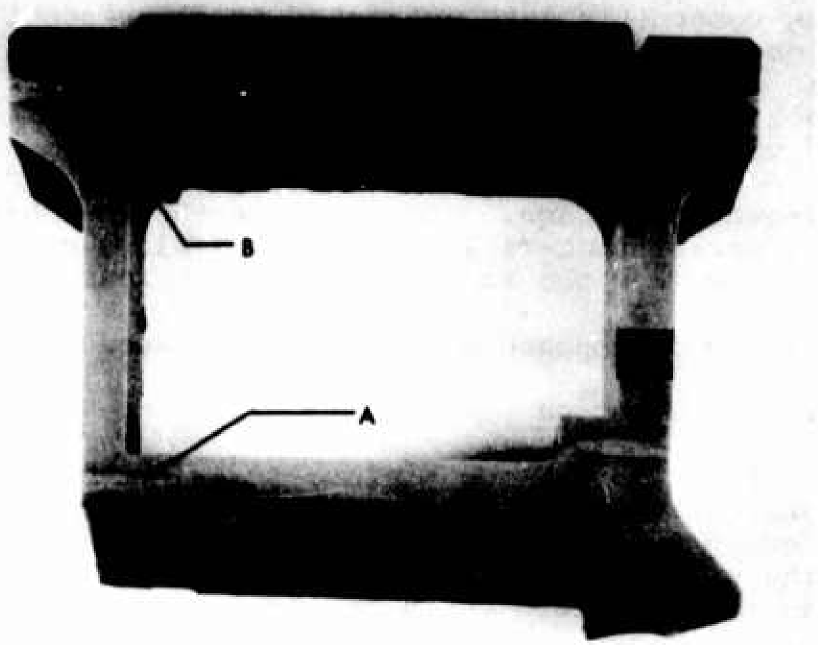


Figure 113. Cross-Section - Second-Row Pinion.

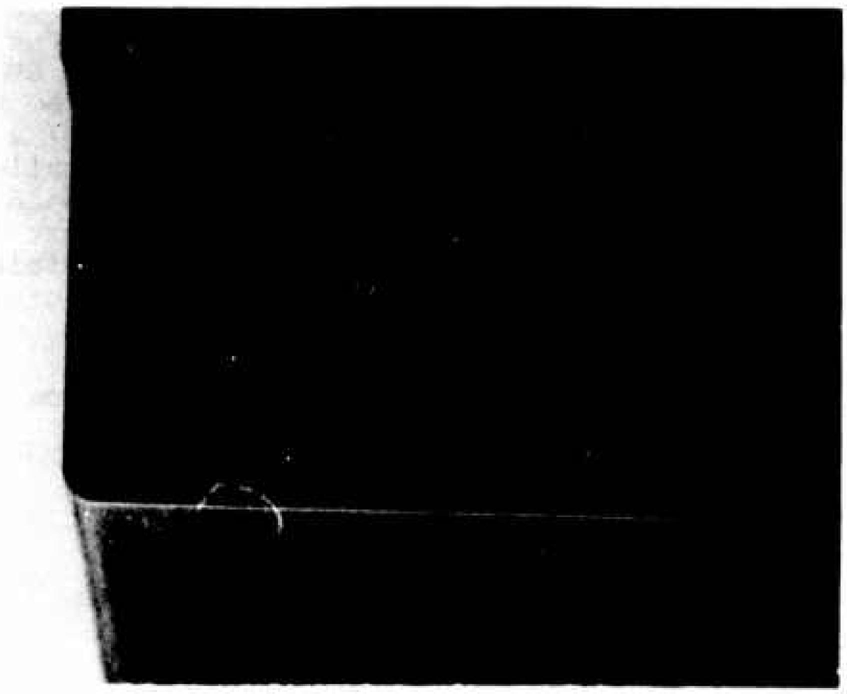


Figure 114. Crack - Bearing Bore.

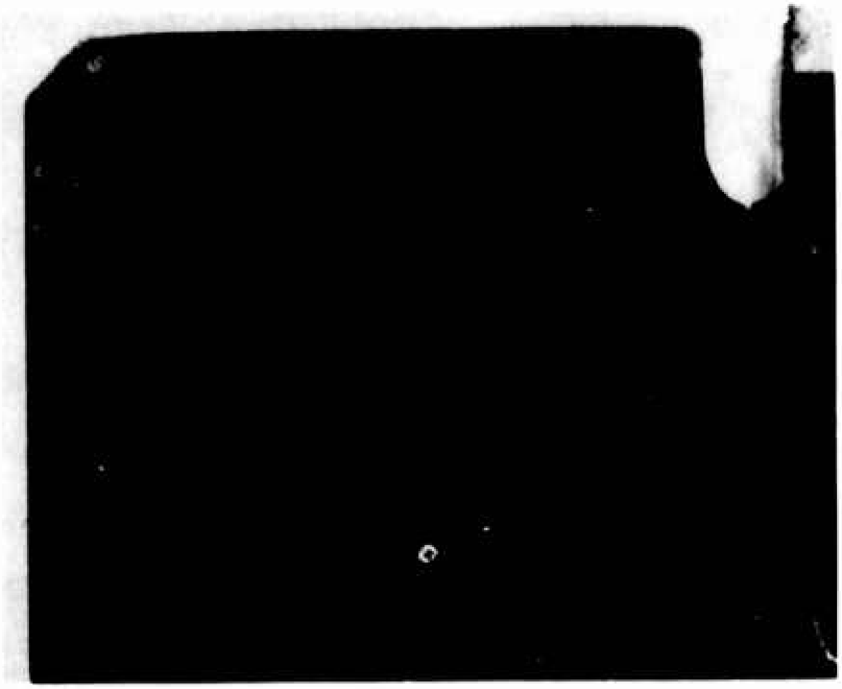


Figure 115. Roller Weld Crack - Second-Row Pinion.

Figure 116. Roller Crack - Electron Beam Weld.

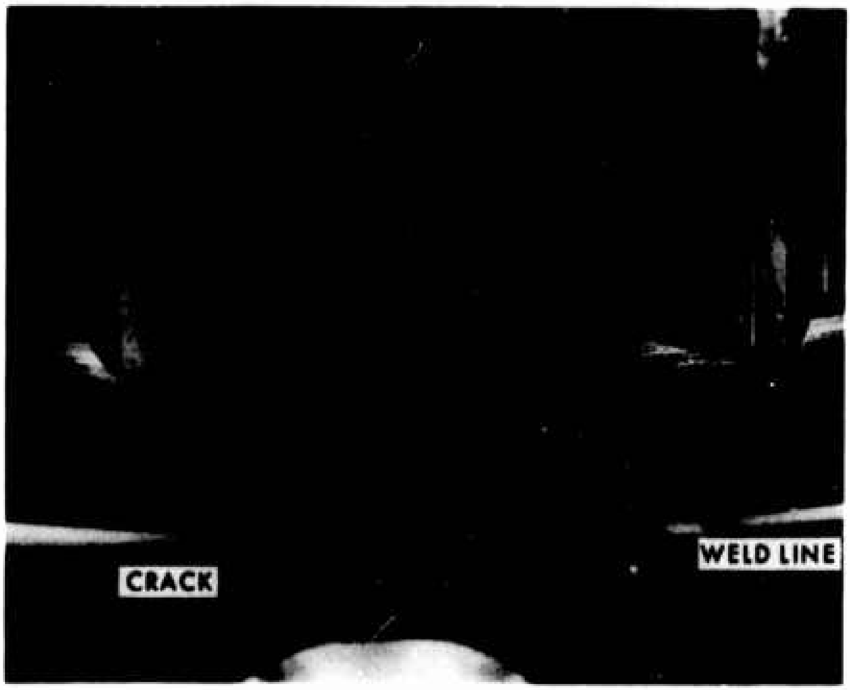


Figure 117. Gear/Flange Radius - Second-Row Pinion.

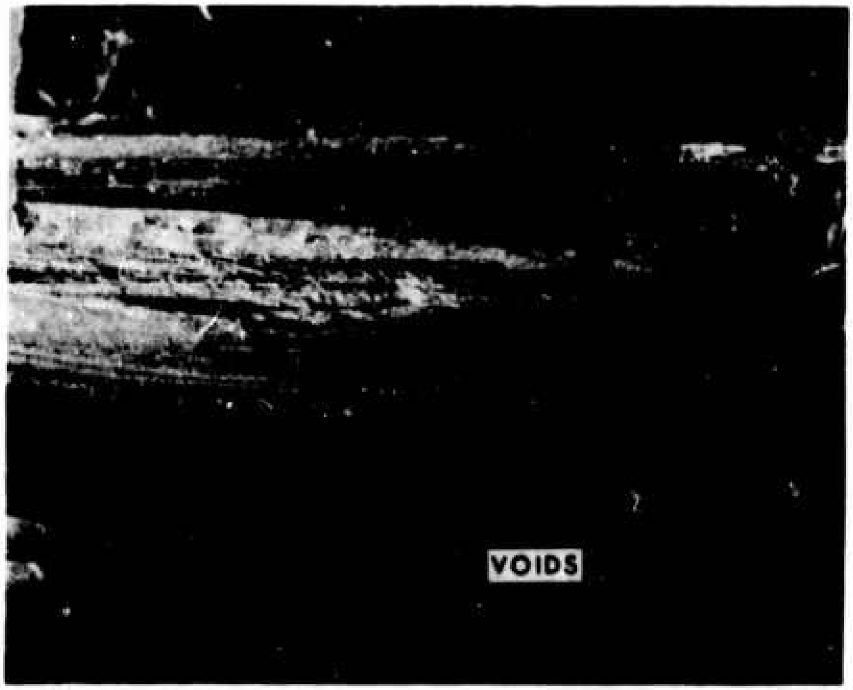


Figure 118. Weld Splatter - Gear/Flange Weld.

Figure 119. Fatigue Crack - Gear/Flange, Second-Row Pinion.

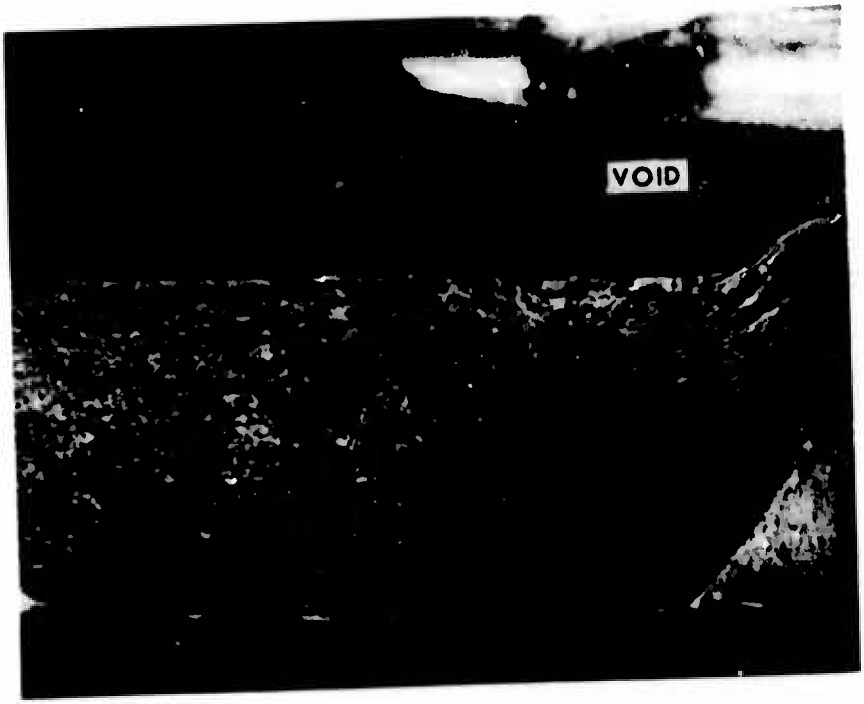


Figure 120. Crack Origin - Electron Beam Weld Void.

EFFICIENCY TEST

Coincident with the 200-hour endurance test, an efficiency test was performed on the roller gear drive test gearbox. After the first 110 hours of the 200-hour endurance test had been completed, layers of fiberglass insulation were installed around the test gearbox and the oil line between the test gearbox and the water-oil heat exchanger. Water temperature into and out of the heat exchanger was then monitored for a series of operating conditions.

Efficiency Test Results

Assuming no heat losses from the gearbox or oil line, the friction horsepower of the gearbox was calculated by assuming it to be equal to the heat absorbed by the water in the heat exchanger.

Then:

$$FHP = 0.02356 \; Q \; (h_2 - h_1)$$

where

FHP	=	friction horsepower of test gearbox
0.02356	=	conversion factor, Btu/min into horsepower
Q	=	water mass flow rate, lb/min
h_2	=	enthalpy of water at exit temperature (T_2)
h_1	=	enthalpy of water at inlet temperature (T_1)

The data resulting from this test is presented in Table XX and a sample calculation appears below.

TABLE XX. GEARBOX EFFICIENCY, TEST RESULTS

Input Power (hp)	Tail Power (hp)	T_1 (°F)	T_2 (°F)	h_1 (Btu/lb)	h_2 (Btu/lb)	Q Water Mass Flow Rate (lb/min)	Frictional Power (hp)
1100	250	35	109.4	3.02	77.34	48.78	85.4
1950	250	35	113.0	3.02	80.94	48.59	89.2
2400	250	35	91.4	3.02	59.39	67.77	90.0
2700	250	37	86.0	5.04	54.00	78.43	90.5
3000	425	36	86.0	4.03	54.00	77.52	91.3
3560	425	36	95.0	4.03	62.98	71.09	98.7
3700	425	36	91.4	4.03	59.39	75.97	98.4
1950	250	37	93.2	4.05	61.18	65.57	86.7
2400	250	36	96.8	4.03	64.78	64.65	92.5
2700	250	37	93.2	5.04	61.18	71.43	94.5
3000	425	36	87.8	4.03	55.80	78.74	96.0
3560	425	36	95.0	4.03	62.98	72.11	100.2
3700	425	36	93.2	4.03	61.18	76.73	103.3

Sample Test Point Data

For an input horsepower of 1950 and a tail horsepower of 250:

Q = 48.59 lb/min

T_1 = 35°F

T_2 = 113°F

h_1 = 3.02 Btu/lb

h_2 = 80.94 Btu/lb

FHP = (0.2356) (48.59) (80.94 - 3.02)

FHP = 89.2

A plot of friction horsepower versus total input power is presented in Figure 121, while Figure 122 shows a plot of test gearbox efficiency versus total input power.

The efficiency of the gearbox at any input power is found from knowing the frictional horsepower at that particular input horsepower.

Thus:

$$\text{Friction hp} = 76.14 + 0.0065\,(\text{input hp})$$

And

$$\text{Gearbox Efficiency, \%} = \frac{\text{input hp} - \text{friction hp}}{\text{input hp}} \times 100$$

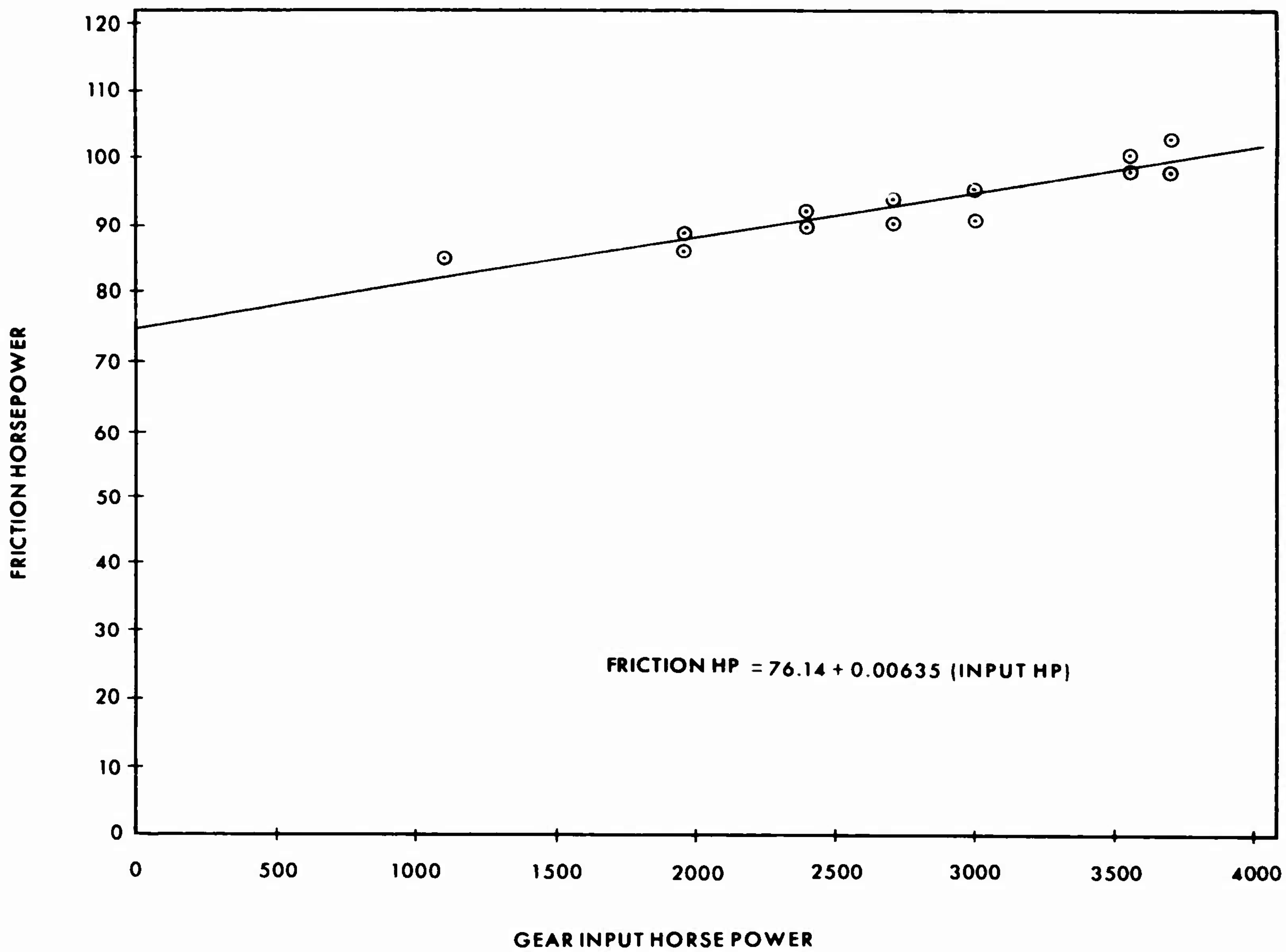


Figure 121. Gearbox Friction Horsepower Versus Total Input Power.

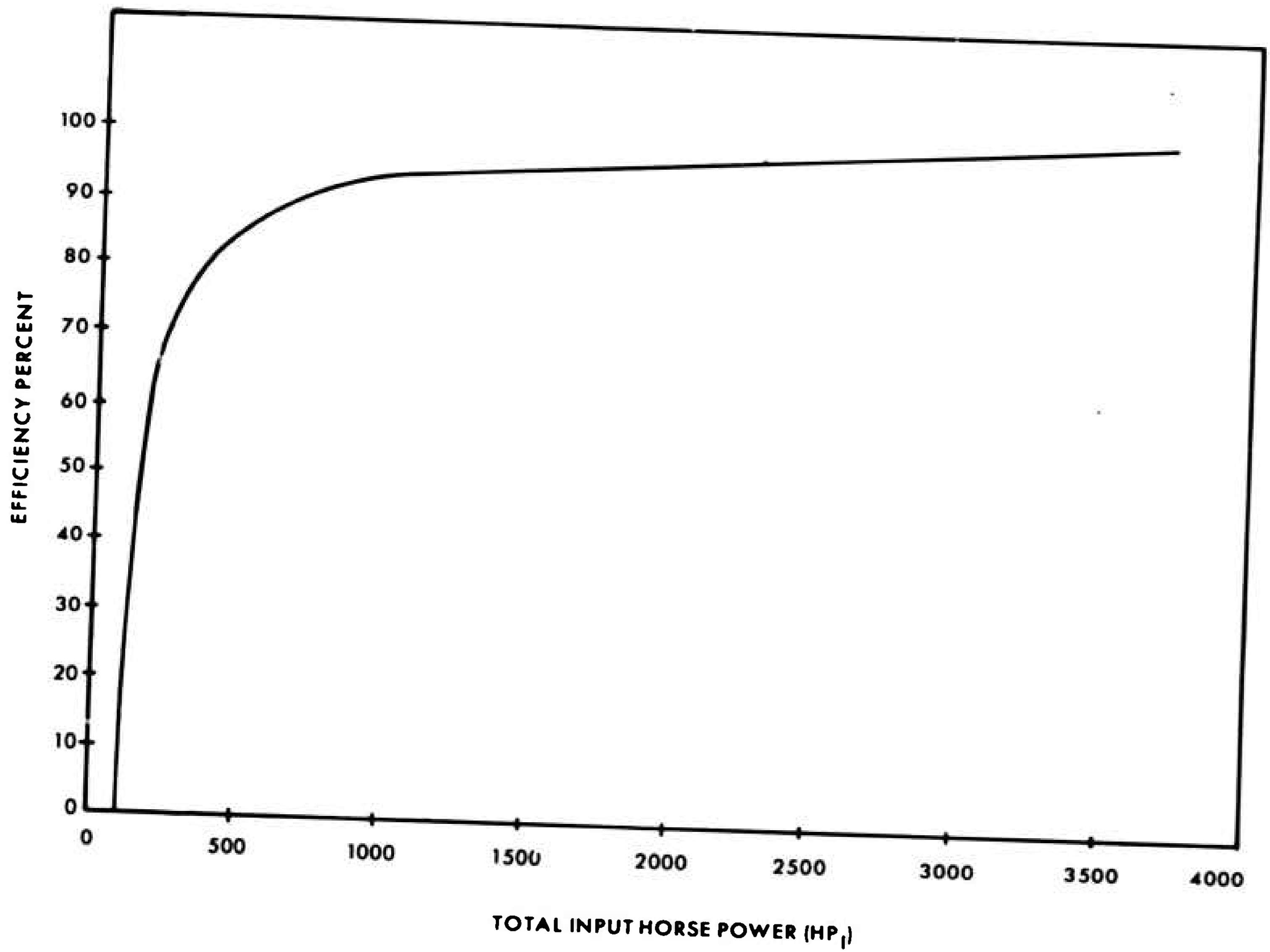


Figure 122. Test Gearbox Efficiency Versus Total Input Power.

CONCLUSIONS

As a result of more than 250 hours of endurance testing, the following conclusions have been reached.

1. The roller gear unit proved it could perform for extended periods of time in the fatigue environment of a helicopter transmission.

2. Nearly all the major problems encountered in the earlier phases of testing were electron beam weld related problems. The majority of these problems have been resolved.

3. The ramp roller clutch type freewheel unit incorporated in the roller gear transmission performed exceedingly well, requiring only one slight adjustment of spring stiffness during the entire period of testing.

4. The roller gear unit exhibited excellent loading characteristics with very uniform loading of both first- and second-row pinions.

5. The roller surfaces supporting the roller gear unit completed the 200-hour endurance test in nearly perfect condition.

6. The compliant bearings tested in the gear development phase of testing require some design modification to permit greater shaft misalignment, perhaps by increased end play.

7. The chip detection system employed during testing performed exceedingly well in providing indications of failure within the roller gear transmission. The compartmentalization feature of this system also permitted rapid pinpointing of the failed component.

8. Lubrication of the quill shaft splines within the transmission during these tests was deemed inadequate, and further work is necessary to provide these splines with a greater supply of lubricant.

9. Spherical bearing spacers used within the second-row pinions exhibited excessive wear and should be modified to alleviate this problem.

10. The efficiency of the roller gear transmission at the maximum design power of 3,700 hp is 97.3%. This efficiency compares favorably to transmissions of conventional design. Efficiency tests for the roller gear drive unit alone were not conducted. This task will be accomplished during subsequent testing of the roller gear drive unit.

11. Ultrasonic inspection methods and acceptance criteria for electron beam welds were developed during this program and proved to be excellent tools in the evaluation of electron beam welded components.

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APPENDIX I

ROLLER GEAR TRANSMISSION - TEST DATA

Table XXI contains the data monitored on the test and dummy gearboxes during the bench tests. The total test time accumulated by both gearboxes during the gear pattern development, initial, and 200-hour endurance tests totaled 256 hours 56 minutes. Testing was initiated on 7/6/71 and concluded 1/19/73.

The total input horsepower is the power to the dual inputs of the test gearbox. It is computed from the power measured in the test main rotor shaft less the tail power and gearbox friction power. Wheatstone bridge signals are transmitted from the strain gaged main rotor and tail drive shafts through silver graphite bushes to a light beam oscillograph.

The test and dummy gearboxes are each equipped with 48 thermocouples to record bearing, oil-in, oil-out, and ambient temperatures. Two 24-channel 2-bank recorders identify, indicate and print out the thermocouple temperature.

The total oil flow to each gearbox and oil flow to each roller gear unit was monitored using a flow turbine. Oil pressure at the gearbox lubrication pumps, manifolds and two input extensions to the dummy gearbox was monitored on direct reading pressure gages.

T

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1 2 3 4 5 6 7 8 9
7/6/71	10:05	00:00	0	0	DUMMY TEST	Start on power at 10:05 Test stand check out both test and du
7/6	11:23	01:18	0	0	DUMMY TEST	83 109 114 119 105 100 99 110 110 1 59 67 71 70 73 73 74 74 87
7/9	13:26	01:18	0	0	DUMMY TEST	Start on power at 13:26 1/2 speed 00:35 at zero load, 00:06 at 25% lo
7/9	14:13	02:05	50%	0	DUMMY TEST	Stop inspect gear patterns
7/9	14:15	02:05	75%	0	DUMMY TEST	Start on power at 14:15 1/2 spee 00:06 at 75% load and 00:15 at 100%
7/9	14:36	02:26	100%	0	DUMMY TEST	75 85 94 93 92 78 90 86 94 55 63 66 83 65 80 67 86 73
7/12	14:36	02:26	0	0	DUMMY TEST	Start on power at 15:05 Dual shaft
7/12	15:00	02:29	100%	0	DUMMY TEST	Stop check temperatures
7/12	16:10	02:29	0	0	DUMMY TEST	Start on power at 16:10 Dual shaft fu
7/12	16:13	02:32	100%	0	DUMMY TEST	78 106 100 111 92 94 91 99 99 11 83 85 104 105 102 100 100 95 105 10
7/13	13:40	03:42	0	0	DUMMY TEST	Start on power at 9:50 tail loop check 00:25 at zero load, 00:15 at 100 H.P.,

A

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY

TEMPERATURE (°C)																						
7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
th test and dummy installed (No input shafts)																						
99	110	110	122	100	104	80	103	101	106	96	92	92	88	93	96	87	85	90	86	76	73	63
74	74	87	88	90	90	74	90	89	92	99	83	73	90	80	80	79	79	80	74	77	80	71
1/2 speed gear pattern test (R/H Test - L/H Dummy only)																						
:06 at 25% load and 00:06 at 50% load (50% Load = 925 S.H.P.)																						
erns																						
1/2 speed gear pattern test (R/H Test - L/H Dummy only)																						
0:15 at 100% load (100% Load = 1850 S.H.P.)																						
90	86	94	97	83	83	76	84	87	84	79	81	80	85	85	84	84	85	84	85	77	70	59
67	86	73	82	72	73	62	72	86	73	71	71	72	130	131	131	117	121	124	116	68	69	69
Dual shaft full speed																						
es																						
) Dual shaft full speed																						
91	99	99	116	88	93	79	94	88	93	81	75	78	72	76	75	65	70	76	71	69	70	52
100	95	105	105	95	95	68	92	94	95	86	82	81	145	148	137	131	122	129	121	70	70	66
tail loop check out																						
15 at 100 H.P., 00:15 at 250 H.P. and 00:15 at 425 S.H.P.																						

…TORY BACK-TO-BACK TEST (SHEET 1)

																					PUMP…
																					FLOW
8	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL ROLLE…
3	63	71	62	60	60	82	72	83	78	95	82	74	67	75	73	76	75	75	73	36	19.8
0	71	67	65	65	65	79	67	84	84	77	82	70	68	68	67	76	80	80	74		23.5
[illegible]	59	69	85	57	58	77	69	75	60	85	78	64	68	72	66	82	67	66	63	34	17.4
[illegible]	69	68	62	62	60	63	59	69	68	62	60	60	59	60	60	70	70	71	65		19.8
[illegible]	52	57	60	50	49	65	58	68	68	84	67	61	67	62	61	58	56	66	61	34	18.0
	66	65	65	53	62	74	63	80	80	90	77	68	62	60	60	70	75	73	69		22.8

SHEET 1)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
3	95	82	74	67	75	73	76	75	75	73	36	19.8		58	34	32	32	18	16
4	77	82	70	68	68	67	76	80	80	74		23.5		70	42	39	39		
	85	78	64	68	72	66	82	67	66	63	34	17.4		48	29	25	24	15	15
	62	60	60	59	60	60	70	70	71	65		19.8		56	36	31	31		
	84	67	61	67	62	61	58	56	66	61	34	18.0		60	35	31	30	15	15
	90	77	68	62	60	60	70	75	73	69		22.8		70	43	41	41		

TABL

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
8/17/71	16:40	03:42				Start on power at 16:40									
8/17	17:15	04:17				Stop input shaft problem									
8/19						Start single shaft L/H on power at 13:10									
8/19	13:10	04:17	1850	100	DUMMY	98	112	114	124	103	109	100	117	115	133
					TEST	60	87	115	112	113	75	110	78	114	97
8/19	14:10	05:17	1850	100	DUMMY	97	111	114	124	103	108	99	116	114	132
					TEST	62	89	114	112	113	74	110	78	114	97
						Start single shaft R/H on power at 15:00									
8/19	15:00	05:17	1850	100	DUMMY	102	96	127	126	105	98	94	105	115	118
					TEST	71	64	66	69	71	104	71	102	93	108
8/19	16:00	06:17	1850	100	DUMMY	102	100	119	118	107	101	105	107	117	120
					TEST	69	71	70	73	72	105	72	103	95	111
						Start dual shaft on power at 09:50									
8/20	09:56	06:23	2200	200	DUMMY TEST	Stop to check torque split									
						Start on power at 12:38									
8/21	12:50	06:35	2200	250	DUMMY	86	92	111	114	97	98	96	105	109	121
					TEST	85	87	105	105	100	94	95	92	96	98
8/21	13:20	07:05	2200	250	DUMMY	93	100	116	120	104	105	103	112	116	128
					TEST	96	99	115	115	112	107	109	105	113	113
						Start on power at 13:40									
8/21	14:10	07:35	2200	250	DUMMY	92	99	115	118	102	103	101	110	114	126
					TEST	70	100	114	114	110	105	107	102	111	111

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA;LAB

	TEMPERATURE (																						
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
ver at 16:40																							
shaft problem																							
e shaft L/H on power at 13:10																							
	124	103	109	100	117	115	133	105	110	93	111	101	108	97	90	95	94	90	94	94	92	95	83
	112	113	75	110	78	114	97	103	102	85	100	98	101	92	89	83	85	86	86	89	86	94	90
	124	103	108	99	116	114	132	104	110	92	110	100	108	96	90	94	92	89	83	92	91	94	82
	112	113	74	110	78	114	97	102	101	85	99	98	101	92	88	84	84	85	88	88	85	93	89
le shaft R/H on power at 15:00																							
	126	105	98	94	105	115	118	103	105	88	106	97	103	93	87	90	90	85	91	88	87	89	79
	69	71	104	71	102	93	108	96	98	80	95	102	99	88	83	78	79	79	79	81	78	82	82
	118	107	101	105	107	117	120	104	106	91	107	99	104	94	88	93	90	88	93	91	90	90	80
	73	72	105	72	103	95	111	97	100	81	96	102	100	89	86	82	83	83	83	86	83	88	86
shaft on power at 09:50																							
eck torque split																							
ower at 12:38																							
.	114	97	98	96	105	109	121	96	100	80	99	65	92	87	80	81	81	79	85	83	83	83	73
5	105	100	94	95	92	96	98	90	90	70	86	87	90	78	72	68	63	63	63	62	63	77	70
5	120	104	105	103	112	116	128	103	107	89	106	72	98	94	88	92	90	88	93	92	91	93	83
5	115	112	107	109	105	113	113	103	104	83	100	101	104	92	90	90	88	89	89	90	87	97	92
ower at 13:40																							
5	118	102	103	101	110	114	126	101	106	90	105	65	95	92	85	94	99	87	91	91	91	92	80
4	114	110	105	107	102	111	111	102	102	81	98	100	102	90	88	87	85	85	85	88	85	94	89

LABORATORY BACK-TO-BACK TEST (SHEET 2)

TURE (°C)

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
83	76	66	59	69	72	53	54	80	71	82	75	98	72	74	69	75	73	77	72	72	70	36
90	79	72	71	71	66	59	58	82	69	86	87	90	84	70	68	71	72	78	84	84	68	
82	75	66	59	69	71	53	53	79	70	81	75	98	71	72	69	75	73	76	72	71	70	37
89	79	71	71	71	66	59	58	82	69	87	88	90	84	71	69	73	73	78	84	84	69	
79	76	75	67	75	74	71	69	80	74	82	83	96	77	76	67	76	75	76	75	77	76	38
82	76	70	67	67	65	57	56	79	66	82	83	86	82	70	68	70	71	74	80	77	66	
80	75	65	59	68	71	53	54	81	71	81	75	97	70	73	67	74	73	76	73	72	70	38
86	79	70	71	70	66	59	58	82	68	85	88	89	84	70	68	73	73	77	83	82	68	
73	69	61	55	63	66	50	50	75	64	74	68	89	64	65	61	65	65	69	67	66	64	35
70	69	62	62	68	63	54	52	69	58	69	68	82	69	55	61	57	57	66	72	66	58	
83	77	68	61	72	75	55	55	83	72	83	74	98	72	74	68	74	72	77	75	74	71	36
92	82	77	77	73	75	70	69	80	73	88	91	98	87	71	70	72	73	79	80	77	68	
80	75	66	60	69	72	55	54	81	72	81	77	97	72	76	64	76	74	75	73	74	71	38
89	86	74	73	72	74	74	69	84	82	87	91	95	85	71	68	73	74	78	85	83	69	

HEET 2)

7	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
5	98	72	74	69	75	73	77	72	72	70	36	22.5		70	43	40	40	21	20
7	90	84	70	68	71	72	78	84	84	68		23.4		67	48	42	41		
5	98	71	72	69	75	73	76	72	71	70	37	22.5		71	43	40	36	21	20
3	90	84	71	69	73	73	78	84	84	69		23.4		67	48	42	41		
3	96	77	76	67	76	75	76	75	77	76	38	22.2		72	44	41	37	21	20
3	86	82	70	68	70	71	74	80	77	66		23.4		68	49	42	41		
5	97	70	73	67	74	73	76	73	72	70	38	22.4		70	42	37	40	20	21
3	89	84	70	68	73	73	77	83	82	68		23.4		68	48	40	42		
3	89	64	65	61	66	65	69	67	66	64	35	22.2		74	44	42	39	23	21
3	82	69	55	61	57	57	66	72	66	58		23.4		67	48	42	40		
	98	72	74	68	74	72	77	75	74	71	36	22.8		73	44	42	39	23	21
	98	87	71	70	72	73	79	80	77	68		23.7		67	48	42	40		
	97	72	76	64	76	74	75	73	74	71	38	22.8		71	43	42	38	22	21
	95	85	71	68	73	74	78	85	83	69		23.7		67	48	42	40		

TABLE

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
8/21/71	14:40	08:05	2700	250	DUMMY TEST	95 71	102 103	119 114	122 114	107 112	107 106	106 109	115 104	118 113	130 112
						Start on power at 15:15									
8/21	15:45	08:35	2700	250	DUMMY TEST	96 97	101 101	115 114	119 114	103 111	104 105	102 108	111 103	114 111	126 111
						Start on power at 15:15									
8/21	16:20	09:05	3240	250	DUMMY TEST	98 97	100 102	113 113	117 113	101 111	103 105	100 108	109 103	111 110	125 110
8/21	16:50	09:35	3240	250	DUMMY TEST	99 97	100 102	114 113	118 114	101 111	103 105	101 108	110 103	112 112	126 110
						Stop increase tail load on power at 17:									
8/21	17:45	10:05	3500	425	DUMMY TEST	103 96	98 101	115 102	117 102	102 110	103 104	100 107	110 102	113 109	125 109
						Stop walk around inspection on pow									
8/21	19:05	10:35	3500	425	DUMMY TEST	99 96	97 100	114 112	117 112	101 110	102 104	100 107	109 102	112 109	124 110
8/21	19:35	11:05	3500	425	DUMMY TEST	101 97	93 98	114 112	117 112	101 111	103 105	100 108	109 103	113 112	125 111
8/21	20:05	11:35	3500	425	DUMMY TEST	101 97	93 98	114 112	117 112	101 111	103 105	100 109	109 103	113 112	126 111
8/21	21:27	11:38	3700	425		Start on power at 21:24 Stop check facility									
8/21	23:22	11:45	3500	425		Start on power at 23:15 Stop check facility									
						Start on power at 02:15									
8/23	02:15	11:45	2200	250	DUMMY TEST	60 90	86 97	101 111	104 110	84 108	88 103	86 104	94 100	96 107	107 107

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA;LABORATORY BACK-

TEMPERATURE (°C)																							
8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	3
115	118	130	106	110	93	109	101	108	97	91	97	95	95	96	97	98	95	85	78	69	63	72	7
104	113	112	103	103	83	99	102	103	92	90	90	89	88	88	93	89	96	92	82	76	75	74	7
111	114	126	102	106	89	106	98	104	93	87	96	94	91	93	94	95	92	82	76	67	61	69	7
103	111	111	102	103	83	99	101	102	91	89	90	89	88	86	92	90	94	92	81	76	74	74	7
109	111	125	99	104	87	104	96	102	91	84	94	95	90	91	95	95	93	80	73	65	60	67	7
103	110	110	101	102	82	98	101	101	90	88	90	91	89	86	94	92	96	93	80	74	74	74	6
110	112	126	100	104	87	104	97	102	91	84	95	95	91	91	95	96	93	81	73	65	59	67	7
103	112	110	101	103	82	98	101	101	90	89	90	91	89	86	94	92	96	93	80	74	74	74	7
power at 17:15																							
110	113	125	100	104	88	105	97	103	91	84	94	92	90	92	90	92	93	82	75	68	61	70	7
102	109	109	100	101	81	97	102	101	89	87	88	90	88	85	93	91	95	93	80	76	74	74	7
on power at 18:35																							
109	112	124	100	104	86	104	96	103	91	84	94	92	91	91	95	95	93	80	75	68	61	70	7
102	109	110	100	101	81	97	101	101	88	87	87	89	87	85	93	90	94	92	81	78	76	77	7
109	113	125	100	104	87	105	97	103	91	84	95	92	91	91	95	96	94	81	75	68	61	70	7
103	112	111	101	103	82	98	102	102	89	88	89	90	89	86	93	91	95	93	82	79	76	77	7
109	113	126	100	104	87	105	97	103	91	84	95	92	90	91	95	96	94	81	75	68	61	70	7
103	112	111	101	103	82	98	102	102	90	88	89	90	89	86	93	91	95	93	82	79	76	77	7
94	96	107	82	88	74	88	62	80	76	69	77	75	67	73	73	75	76	64	60	54	49	55	5
100	107	107	98	99	77	93	96	97	85	81	77	77	77	77	77	77	91	82	77	74	68	71	7

B

ORY BACK-TO-BACK TEST (SHEET 3)

28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	PU FLOW TOTAL ROL
69	63	72	75	58	57	84	74	84	78	101	75	77	70	77	75	79	76	77	73	41	22.4
76	75	74	75	76	71	69	87	76	90	95	98	88	75	69	76	76	80	87	72		23.7
67	61	69	73	57	56	81	72	81	76	97	73	74	67	75	74	76	73	76	72	41	23.1
76	74	74	70	64	63	85	86	76	88	90	98	87	74	69	75	76	79	85	85		23.8
65	60	67	70	56	54	78	69	79	75	96	70	72	64	74	72	73	70	71	70	41	22.5
74	74	74	69	64	63	84	72	87	90	92	86	74	68	74	75	78	85	85	71		23.4
65	59	67	70	56	54	78	69	79	75	96	70	72	64	73	72	73	70	71	69	41	22.5
74	74	74	71	66	63	84	73	88	91	98	85	74	74	76	76	79	85	84	71		23.7
68	61	70	73	57	56	80	70	81	75	97	71	73	65	74	72	75	71	74	71	41	22.5
76	74	74	77	68	69	79	74	88	94	85	84	66	77	77	81	86	85	71	71		23.4
68	61	70	74	57	55	81	70	81	74	96	71	72	65	73	72	75	71	72	70	39	22.5
78	76	77	77	69	71	85	74	88	93	97	87	73	68	76	76	79	87	85	70		23.4
68	61	70	74	57	55	81	71	82	75	97	72	74	64	75	73	75	72	73	71	39	22.5
79	76	77	78	70	71	86	76	90	95	98	88	77	68	77	77	79	88	86	71		23.4
68	61	70	74	57	55	81	71	82	75	97	72	73	64	75	73	75	72	73	71	39	22.5
79	76	77	78	70	71	86	76	90	95	98	88	77	68	77	77	79	88	86	71		23.4
54	49	55	58	45	44	66	57	66	65	80	58	60	47	63	61	53	58	60	58	32	21.6
74	68	71	71	66	68	79	68	79	79	91	82	63	68	63	66	74	79	74	63		

C

7)

											PUMP		MANIFOLD PRESS			DUMMY INPUT PRESS	
											FLOW						
38	39	40	41	42	43	44	45	46	47	48	TOTAL ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
.01	75	77	70	77	75	79	76	77	73	41	22.4	71	44	41	38	22	21
95	98	88	75	69	76	76	80	87	72		23.7	67	48	42	40		
97	73	74	67	75	74	76	73	76	72	41	23.1	74	42	43	39	23	22
90	98	87	74	69	75	76	79	85	85		23.8	67	48	42	40		
96	70	72	64	74	72	73	70	71	70	41	22.5	73	44	42	38	22	21
92	86	74	68	74	75	78	85	85	71		23.4	67	48	42	41		
96	70	72	64	73	72	73	70	71	69	41	22.5	73	44	42	38	22	21
96	85	74	74	76	76	79	85	84	71		23.7	67	48	42	41		
97	71	73	65	74	72	75	71	74	71	41	22.5	72	42	43	38	21	30
85	84	66	77	77	81	86	85	71	71		23.4	67	48	42	40		
96	71	72	65	73	72	75	71	72	70	39	22.5	72	42	42	38	21	23
97	87	73	68	76	76	79	87	85	70		23.4	67	48	42	40		
97	72	74	64	75	73	75	72	73	71	39	22.5	72	42	42	38	21	23
98	88	77	68	77	77	79	88	86	71		23.4	67	48	42	40		
97	72	73	64	75	73	75	72	73	71	39	22.5	72	42	42	38	21	23
98	88	77	68	77	77	79	88	86	71		23.4	67	48	42	40		
30	58	60	47	63	61	53	58	60	58	32	21.6	79	46	44	40	21	23
1	82	63	68	63	66	74	79	74	63								

TA

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	
8/23/71	02:45	12:15	2200	250	DUMMY	68	95	116	118	100	103	100	109	114	1
					TEST	91	92	110	109	107	102	105	99	107	1
8/23	03:15	12:45	2200	250	DUMMY	69	95	118	121	107	105	105	114	117	1
					TEST	95	96	111	110	109	103	107	101	111	1
						Stop check facility on power at 0335									
8/23	04:05	13:15	2200	250	DUMMY	68	100	117	120	105	105	104	113	116	1
					TEST	94	100	112	112	110	104	107	102	110	1
8/23	04:35	13:45	2200	250	DUMMY	68	101	117	121	106	105	105	113	116	1
					TEST	94	101	113	112	110	105	107	102	112	1
8/23	05:05	14:15	2700	250	DUMMY	70	96	117	121	106	106	105	113	116	12
					TEST	96	98	113	112	111	106	108	104	113	11
8/23	05:35	14:45	2700	250	DUMMY	70	96	117	120	105	105	104	113	116	12
					TEST	95	102	114	113	112	106	109	104	113	11
						Start on power at 06:15									
8/23	06:28	14:58	2700	250		Stop check facility									
						Start on power at 07:55									
8/23	08:25	15:28	2700	250	DUMMY	70	96	115	118	103	103	102	111	114	12
					TEST	83	101	113	113	110	104	108	102	111	11
						Stop increase tail load on power at									
8/23	10:00	15:58	3240	425	DUMMY	70	95	116	119	104	105	103	112	113	12
					TEST	96	102	114	114	113	107	110	105	113	11
8/23	10:30	16:28	3240	425	DUMMY	71	96	116	119	105	105	103	112	115	12
					TEST	97	99	114	114	113	107	111	105	115	11
8/23	11:00	16:58	3240	425	DUMMY	73	97	118	121	107	107	105	114	118	13
					TEST	98	99	114	114	113	108	111	106	115	11

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:L

TEMPERATU

3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
116	118	100	103	100	109	114	125	100	104	83	103	67	94	91	83	90	89	85	90	89	89	88
110	109	107	102	105	99	107	107	98	99	80	95	98	99	87	85	86	84	85	82	87	85	93
118	121	107	105	105	114	117	128	104	108	92	108	68	98	94	90	98	94	93	95	95	94	94
111	110	109	103	107	101	111	110	110	101	81	96	100	100	89	87	87	85	86	83	88	85	94
eck facility on power at 0335																						
117	120	105	105	104	113	116	126	104	108	90	107	85	99	95	89	97	93	91	94	94	94	92
112	112	110	104	107	102	110	110	100	101	81	97	101	101	89	87	87	86	85	84	89	87	95
117	121	106	105	105	113	116	128	104	108	91	108	85	102	95	89	98	93	91	94	94	94	92
113	112	110	105	107	102	112	110	101	102	82	98	101	101	90	88	88	87	86	84	89	87	96
117	121	106	106	105	113	116	129	104	108	92	108	100	107	95	89	98	95	93	95	96	97	94
113	112	111	106	108	104	113	111	102	104	83	99	102	102	91	89	88	89	88	87	92	91	96
117	120	105	105	104	113	116	128	104	108	90	108	100	107	95	88	98	95	93	95	96	96	93
114	113	112	106	109	104	113	112	103	104	83	99	102	103	91	90	90	90	89	87	92	91	96
n power at 06:15																						
eck facility																						
n power at 07:55																						
115	118	103	103	102	111	114	125	102	106	89	106	98	104	93	86	96	93	90	92	93	94	91
113	113	110	104	108	102	111	110	101	102	82	98	101	101	89	87	87	87	86	84	89	87	94
ncrease tail load on power at 09:30																						
116	119	104	105	103	112	113	127	103	107	84	107	89	102	92	87	96	95	92	94	96	96	94
114	114	113	107	110	105	113	113	103	105	84	100	105	105	92	90	90	94	90	88	94	93	99
116	119	105	105	103	112	115	128	103	107	90	107	94	106	94	87	97	94	90	93	94	94	93
114	114	113	107	111	105	115	113	104	105	84	100	105	105	92	91	92	94	90	88	94	90	99
118	121	107	107	105	114	118	131	106	109	93	110	101	108	96	89	99	97	95	96	99	99	95
114	114	113	108	111	106	115	113	104	105	84	100	105	105	92	91	92	94	90	89	94	93	99

13

ISSION TEST DATA: LABORATORY BACK-TO-BACK TEST (SHEET 4)

TEMPERATURE (°C)

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	4
89	85	90	89	89	88	83	78	67	57	70	73	54	53	83	70	82	69	94	68	66	78	70	6
84	85	82	87	85	93	88	79	74	72	72	74	66	67	77	71	79	91	93	84	71	72	76	7
94	93	95	95	94	94	85	79	68	60	72	76	55	54	84	73	84	74	99	72	75	71	76	7
85	86	83	88	85	94	89	81	76	74	67	66	67	70	85	74	88	88	96	86	74	68	74	7
93	91	94	94	94	92	84	78	67	60	71	75	55	53	83	72	83	74	98	71	74	70	76	7
86	85	84	89	87	95	89	79	77	74	74	75	68	69	84	74	88	93	96	85	74	68	74	7
93	91	94	94	94	92	84	78	67	60	71	75	55	53	83	72	83	74	98	71	74	70	75	7
87	86	84	89	87	96	90	81	77	74	74	76	68	70	85	76	89	93	96	87	74	74	75	7
95	93	95	96	97	94	85	77	67	60	71	74	55	53	83	77	83	74	99	71	73	69	75	[illegible]
89	88	87	92	91	96	91	81	76	74	74	76	68	69	85	76	89	93	97	87	74	74	74	[illegible]
95	93	95	96	96	93	84	77	67	59	70	73	54	53	82	71	82	74	99	71	73	69	74	[illegible]
90	89	87	92	91	96	92	81	77	74	74	76	68	69	85	76	89	93	98	87	74	74	75	[illegible]
93	90	92	93	94	91	81	77	77	69	75	76	74	70	82	76	83	85	98	79	79	67	81	
87	86	84	89	87	94	89	79	72	71	71	69	60	58	82	69	85	90	95	85	76	67	77	
95	92	94	96	96	94	84	77	69	61	73	76	57	55	83	72	84	75	99	72	73	68	75	
94	90	88	94	93	99	93	84	80	79	79	80	73	74	88	77	89	93	99	90	74	70	76	
94	90	93	94	94	93	84	78	70	62	73	77	57	55	84	72	84	71	98	72	74	68	76	
94	90	88	94	90	99	93	85	81	79	80	80	74	74	88	79	91	96	99	90	78	70	78	
97	95	96	99	99	95	88	79	71	63	75	78	59	57	85	73	86	77	101	73	75	70	76	
94	90	89	94	93	99	93	85	80	79	80	80	74	74	88	79	91	96	99	91	78	69	79	

C

T (SHEET 4)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
69	94	68	66	78	70	69	81	71	68	68	33	23.6	76	45	43	39	23	21
91	93	84	71	72	76	71	76	82	79	66		23.6	66	48	41	40		
74	99	72	75	71	76	74	79	74	73	72	34	23.4	73	44	42	40	23	21.5
88	96	86	74	68	74	74	78	85	83	68		23.7	66	47	41	40		
74	98	71	74	70	76	74	78	72	73	72	35	23.4	75	45	43.5	40	23.5	22
93	96	85	74	68	74	74	78	85	82	68		23.7	66	48	41.5	40		
74	98	71	74	70	75	74	78	72	73	72	34	23.1	73	44	42.5	39	23	21.5
93	96	87	74	74	75	76	79	87	85	70		23.7	66	47	42	40		
74	99	71	73	69	75	73	78	71	73	71	35	22.8	73	44	42	39	23	21.5
93	97	87	74	74	74	75	79	85	84	70		23.7	66	47	41.5	40		
74	99	71	73	69	74	73	77	71	73	71	35	22.8	74	44	42.5	39	23	21.5
93	98	87	74	74	75	76	79	85	85	74		23.7	66	48	42	40		
85	98	79	79	67	81	79	77	77	80	79	32	23.1	75	45	43	40	24	22
90	95	85	76	67	77	77	77	84	81	69		23.4	67	47	43	40		
75	99	72	73	68	75	73	78	73	73	72	36	22.8	74	45	43	39	23	21.5
93	99	90	74	70	76	76	80	88	84	69		23.7	67	47	41.5	40		
71	98	72	74	68	76	74	78	73	74	73	37	22.8	73	44	42.5	39	23	22
96	99	90	78	70	78	78	80	89	87	72		23.7	67	47	41.5	40		
77	101	73	75	70	76	75	80	74	75	74	37	22.8	73	44	42.5	39	23	22
96	99	91	78	69	79	79	81	89	87	72		23.7	67	47	41.5	39		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	
8/23/71	11:30	17:28	3240	425	DUMMY TEST	73 98	97 99	118 114	121 114	107 113	107 108	105 111	114 106	118 115	1 1
						Stop facility problem									
9/7	11:05	17:58	2200	250		Start on power at 10:35									
						Stop check torque split Start on power at 11:40									
9/7	12:10	18:28	2200	250		Stop inspect strainers									
						Start on power at 14:25									
9/9	14:55	18:58	2400	250	DUMMY TEST	91 80	104 98	111 116	115 119	93 110	112 105	96 107	105 103	108 112	1 1
9/9	15:25	19:28	2400	250	DUMMY TEST	96 81	107 98	113 116	118 119	97 110	115 105	99 107	108 103	111 113	1 1
						Stop check torque split						on power at 1			
9/9	16:20	19:58	2700	250	DUMMY TEST	96 84	109 99	115 116	120 119	98 111	117 106	101 117	110 104	113 113	1 11
9/9	16:50	20:28	2700	250	DUMMY TEST	96 85	109 100	115 116	120 120	98 111	118 106	102 108	111 104	114 115	1 11
						Stop check torque split						on power		at	
9/9	17:40	20:58	1950	250	DUMMY TEST	95 80	109 98	114 115	118 118	96 109	115 104	99 106	108 101	111 111	12 11
9/9	18:10	21:28	1950	250	DUMMY TEST	95 81	109 98	114 115	118 119	96 109	115 104	99 106	108 101	111 112	12 11
9/9	18:40	21:58	3000	250	DUMMY TEST	95 87	108 100	114 116	120 119	98 111	117 106	101 108	110 104	113 114	12 11

A

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LA

TEMPERATURE (°C)

5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
7	107	105	114	118	131	106	109	93	110	101	108	96	89	99	97	95	96	99	99	95	88	79	7
3	108	111	106	115	113	104	105	84	100	105	105	92	91	92	94	90	89	94	93	99	93	85	8
lem																							
10:35																							
split																							
11:40																							
ners																							
14:25																							
3	112	96	105	108	118	96	100	88	96	92	98	87	80	86	82	80	84	82	80	79	85	72	6
0	105	107	103	112	110	101	102	82	99	99	101	89	87	87	83	86	92	92	85	55	83	82	7
7	115	99	108	111	123	100	103	92	94	96	102	81	84	91	87	85	89	87	84	82	88	75	6
0	105	107	103	113	111	101	102	82	98	99	101	89	88	88	83	86	92	93	85	55	84	82	7
split on power at 15:50																							
8	117	101	110	113	124	101	105	94	96	98	103	92	85	94	90	89	91	90	89	84	91	76	6
1	106	117	104	113	111	102	102	83	99	100	102	90	88	88	85	87	94	94	90	57	85	82	7
8	118	102	111	114	126	102	106	94	97	99	104	93	86	95	91	88	92	91	89	84	91	76	6
1	106	108	104	115	112	102	103	94	99	101	102	91	89	89	85	89	94	94	89	57	85	83	7
split on power at 17:10																							
6	115	99	108	111	122	99	103	91	94	95	101	90	83	91	85	83	87	86	82	79	86	74	6
9	104	106	101	111	110	100	101	82	96	97	101	88	86	86	81	84	90	90	93	55	83	81	7
6	115	99	108	111	123	99	103	92	95	95	102	90	83	91	85	83	88	87	83	80	86	74	6
9	104	106	101	112	111	100	101	82	97	98	100	89	86	86	81	89	90	90	93	54	83	82	7
8	117	101	110	113	125	101	105	93	96	98	103	92	85	94	91	87	91	90	89	83	90	75	6
11	106	108	104	114	112	101	103	83	98	100	101	90	88	89	85	89	94	94	89	57	87	82	7

B

' DATA:LABORATORY BACK-TO-BACK TEST (SHEET 5)

ATURE (°C)

5	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
5	88	79	71	63	75	78	59	57	85	73	86	77	101	73	75	70	76	75	80	74	75	74	37
9	93	85	80	79	80	80	74	74	80	79	91	96	99	91	78	69	79	79	81	89	87	72	
'9	85	72	64	58	67	69	65	62	77	67	77	75	90	68	71	62	68	68	63	69	68	70	38
;5	83	82	77	77	74	76	71	71	91	77	85	89	96	88	71	75	74	74	78	85	81	67	
32	88	75	66	61	69	72	57	54	80	71	80	78	94	72	76	65	73	72	67	72	72	74	40
;5	84	82	76	76	74	75	71	70	85	77	89	95	95	88	77	69	80	79	80	86	85	71	
34	91	76	67	62	71	73	58	55	82	72	82	80	96	73	76	66	75	73	68	73	74	75	42
;7	85	82	76	76	64	76	71	71	87	78	90	95	97	88	77	70	80	80	81	88	87	72	
34	91	76	67	62	71	73	58	54	82	73	82	79	97	73	76	66	75	73	68	73	74	75	41
;7	85	83	77	77	64	76	72	70	88	79	91	96	98	90	78	70	82	81	81	88	87	71	
79	86	74	65	60	68	71	56	53	79	70	79	78	93	71	72	63	72	71	66	70	71	73	40
55	83	81	74	74	71	73	71	69	85	77	89	94	95	87	77	68	79	78	78	86	84	70	
80	86	74	65	60	68	71	56	53	79	70	79	78	93	71	72	63	72	71	66	70	71	73	40
54	83	82	74	74	71	74	71	69	87	78	90	95	95	88	77	68	79	79	79	87	86	71	
83	90	75	66	60	69	72	56	53	80	71	80	78	96	71	73	65	73	72	67	71	72	74	39
57	87	82	76	76	72	74	71	70	87	79	90	95	98	89	77	70	82	80	81	88	86	71	

C

SHEET 5)

39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
73	75	70	76	75	80	74	75	74	37	22.8		73	44	42.5	39	23	22
91	78	69	79	79	81	89	87	72		23.7		67	48	41.5	39		
68	71	62	68	68	63	69	68	70	38	23.1		78	47	44.5	41	24	21.5
88	71	75	74	74	78	85	81	67		22.5		64	44	36.5	35		
72	76	65	73	72	67	72	72	74	40	23.1		76	46	44.5	41	24	21.5
88	77	69	80	79	80	86	85	71		22.8		64	44	36.5	35		
73	76	66	75	73	68	73	74	75	42	22.8		76	45	43.5	40	23	21
88	77	70	80	80	81	88	87	72		22.5		64	44	37	35		
73	76	66	75	73	68	73	74	75	41	22.8		75	45	43.5	40	23	21
90	78	70	82	81	81	88	87	71		22.5		64	44	37	35		
71	72	63	72	71	66	70	71	73	40	22.8		77	46	44	40	23.5	21
87	77	68	79	78	78	86	84	70		22.5		64	44	37	35		
71	72	63	72	71	66	70	71	73	40	22.8		76	46	44	40	23.5	21
88	77	68	79	79	79	87	86	71		22.5		64	44	37	35		
71	73	65	73	72	67	71	72	74	39	22.8		76	46	43	40	23	21
89	77	70	82	80	81	88	86	71		22.5		64	45	37	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
9/9/71	18:50	22:08	3000	250		Stop check strainer									
						Start on power at 19:15									
9/9	19:35	22:28	3000	250	DUMMY TEST	94 96	107 98	113 114	118 118	97 110	116 106	101 106	110 101	113 110	1 1
						Stop check facility on power at 20:15									
9/9	20:45	22:58	3000	250	DUMMY TEST	94 85	107 97	113 115	118 118	95 109	115 104	99 106	108 102	111 110	1 1
9/9	21:15	23:28	3000	250	DUMMY TEST	95 96	108 99	114 115	119 119	97 110	117 105	100 107	109 102	113 114	12 11
9/9	21:45	23:58	1950	250	DUMMY TEST	95 85	108 97	114 115	120 119	96 108	116 104	100 106	109 101	112 111	12 11
9/9	22:15	24:28	1950	250	DUMMY TEST	95 85	109 97	115 114	120 119	97 108	117 104	101 106	110 102	113 111	12 11
9/9	22:45	24:58	3000	250	DUMMY TEST	94 86	108 99	114 116	120 119	97 111	117 106	101 108	110 104	113 114	12 11
9/9	23:15	25:28	3000	250	DUMMY TEST	94 86	107 99	113 115	118 119	96 110	116 106	100 108	109 104	112 114	12 11
						Stop check torque split on power at 23:									
9/9	24:00	25:58	3000	250	DUMMY TEST	94 85	107 98	113 114	118 118	96 108	116 104	100 106	109 101	111 110	12 11
9/10	00:30	26:28	3000	250	DUMMY TEST	95 86	108 98	114 115	120 119	97 110	117 105	101 107	110 103	113 113	12 11
						Stop inspect strainers									

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY BACK-

TEMPERATURE (°C)

	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
5	102	105	94	96	98	104	93	85	95	92	86	92	90	90	83	91	75	66	60	70	72	55	52
9	104	100	91	97	98	100	86	85	85	83	86	91	91	86	54	85	80	74	74	71	72	70	68
2	99	103	91	94	97	101	90	83	93	89	85	89	88	88	82	89	74	64	58	68	70	54	51
0	100	100	81	97	98	100	87	86	86	84	86	92	91	87	54	85	80	73	73	70	72	69	68
5	101	104	92	95	98	103	92	84	94	91	87	91	88	89	83	90	75	65	58	68	71	54	52
0	100	102	82	97	99	100	89	87	88	85	88	95	94	89	54	87	82	74	74	71	73	70	68
4	100	104	92	94	97	103	92	85	93	88	86	90	87	85	82	88	75	64	58	68	71	54	51
0	100	100	81	96	98	100	88	86	86	81	85	90	91	87	52	83	80	74	74	70	72	69	68
4	101	105	93	95	97	103	92	86	93	88	87	90	87	85	83	89	76	65	58	69	72	54	51
0	99	100	81	96	98	100	87	86	86	81	84	91	92	83	52	83	81	74	74	71	72	70	68
5	101	105	93	95	98	103	92	85	95	92	88	91	86	90	83	91	74	64	57	68	71	53	50
2	101	103	83	97	101	102	90	89	89	87	90	96	97	90	53	88	82	75	75	71	74	71	68
4	99	103	92	94	97	102	90	83	93	90	85	90	86	90	82	89	73	62	56	67	69	52	49
1	101	102	82	98	100	101	89	88	88	86	89	95	95	89	54	87	82	74	74	71	72	70	68
30																							
3	99	103	91	93	97	102	90	83	92	89	85	89	84	88	81	89	73	63	57	67	70	53	50
0	99	100	80	96	98	99	86	85	85	83	86	92	93	86	53	87	80	72	72	69	71	68	66
5	101	105	93	95	98	103	92	85	94	91	87	91	86	89	83	91	75	64	58	68	71	54	50
1	100	101	81	97	99	100	88	86	87	85	87	94	94	88	53	85	81	75	75	69	71	68	67

ORY BACK-TO-BACK TEST (SHEET 6)

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL ROLLER	PUMP PRESS
72	55	52	81	71	81	77	96	71	73	65	72	72	66	71	72	74	37	22.8	75
72	70	68	85	77	87	91	95	92	73	68	79	78	78	85	82	68		22.5	64
70	54	51	79	69	79	76	94	69	71	64	71	70	65	70	70	72	37	22.8	76
72	69	68	85	77	88	93	95	87	74	68	79	78	79	85	81	68		22.5	64
71	54	52	80	70	80	77	95	70	73	64	72	71	65	71	70	73	36	22.8	76
73	70	68	85	77	89	94	96	88	75	68	81	80	80	89	84	69		22.5	64
71	54	51	80	70	80	77	94	70	72	65	72	71	65	71	71	73	35	22.8	76
72	69	68	85	77	88	93	94	87	74	68	80	79	79	85	84	68		22.5	64
72	54	51	81	71	81	77	95	71	73	66	73	72	66	71	71	73	35	22.8	76
72	70	68	85	77	89	94	95	88	74	68	81	79	79	86	84	69		22.5	64
71	53	50	80	70	80	77	96	70	73	64	73	71	65	71	71	73	34	22.8	76
74	71	68	87	78	90	94	98	89	76	69	82	81	81	87	85	69		22.5	64
69	52	49	79	68	79	75	94	69	71	63	71	70	64	69	70	71	34	22.8	76
72	70	68	87	77	89	94	96	88	76	68	82	80	80	87	84	69		22.5	64
70	53	50	79	68	79	75	94	69	70	64	70	69	64	69	70	72	34	22.8	76
71	68	66	84	76	87	88	94	85	74	66	79	78	77	84	84	68		22.5	64
71	54	50	80	70	80	76	95	70	73	65	72	71	65	70	71	73	34	22.8	76
71	68	67	85	77	88	93	95	88	74	67	79	78	78	85	82	67		22.5	63

ST (SHEET 6)

											PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
											FLOW							
38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
96	71	73	65	72	72	66	71	72	74	37	22.8		75	45	43	40	23	21
95	92	73	68	79	78	78	85	82	68		22.5		64	44	37	35		
94	69	71	64	71	70	65	70	70	72	37	22.8		76	45	44	40	23	21
95	87	74	68	79	78	79	85	81	68		22.5		64	44	37	35		
95	70	73	64	72	71	65	71	70	73	36	22.8		76	46	44	40	24	21
96	88	75	68	81	80	80	89	84	69		22.5		64	44	36	35		
94	70	72	65	72	71	65	71	71	73	35	22.8		76	46	44	40	24	21
94	87	74	68	80	79	79	85	84	68		22.5		64	44	36	35		
95	71	73	66	73	72	66	71	71	73	35	22.8		76	46	44	40	23	21
95	88	74	68	81	79	79	86	84	69		22.5		64	44	37	35		
96	70	73	64	73	71	65	71	71	73	34	22.8		76	46	43	40	23	21
98	89	76	69	82	81	81	87	85	69		22.5		64	44	37	35		
94	69	71	63	71	70	64	69	70	71	34	22.8		76	46	44	40	23	21
96	88	76	68	82	80	80	87	84	69		22.5		64	44	36	35		
94	69	70	64	70	69	64	69	70	72	34	22.8		76	46	44	41	23	21
94	85	74	66	79	78	77	84	84	68		22.5		64	44	36	35		
95	70	73	65	72	71	65	70	71	73	34	22.8		76	46	44	40		
95	88	74	67	79	78	78	85	82	67		22.5		63	42	36	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
12/13/71		26:28	2400	250		Start on power at 21:55									
12/13	22:10	26:43	2400	250	DUMMY TEST	83 79	93 66	101 104	106 112	84 101	99 98	85 99	91 96	97 102	113 101
12/13	22:25	26:58	2400	250	DUMMY TEST	85 81	96 67	106 107	110 113	90 105	105 102	91 102	97 100	102 108	120 105
12/13	22:55	27:28	2400	250	DUMMY TEST	88 81	102 68	111 109	116 115	97 107	112 104	97 105	105 102	109 110	127 107
12/13	23:25	27:58	2700	250	DUMMY TEST	89 81	102 69	112 108	118 114	98 107	114 104	98 105	106 102	110 110	129 107
12/13	23:55	28:28	2700	250	DUMMY TEST	89 81	101 69	112 109	118 115	98 107	114 104	98 105	106 102	110 111	129 108
12/14	00:25	28:58	3000	250	DUMMY TEST	90 81	102 69	113 109	118 115	95 108	116 105	97 106	107 103	111 112	130 108
12/14	00:55	29:28	3000	250	DUMMY TEST	90 81	103 69	113 110	119 116	100 108	116 105	100 106	108 103	111 112	131 108
12/14	01:25	29:58	2700	250	DUMMY TEST	90 80	103 68	113 109	119 115	99 108	116 105	100 106	107 102	111 111	131 108
12/14	01:55	30:28	2700	250	DUMMY TEST	90 80	103 68	113 109	119 115	99 108	115 105	100 106	107 102	112 111	131 108
12/14	02:25	30:58	2700	250	DUMMY TEST	90 80	103 68	113 109	119 115	99 108	115 105	100 105	107 102	111 111	131 108

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABC

TEMPERATURE (°C)

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1:55																						
99	85	91	97	113	83	87	74	76	78	86	71	69	72	69	82	69	62	69	69	70	59	51
98	99	96	102	101	93	93	93	89	96	94	82	80	81	78	81	73	80	73	81	79	76	57
105	91	97	102	120	89	93	78	81	84	93	78	75	78	76	87	75	66	75	75	77	64	55
102	102	100	108	105	96	96	96	92	99	98	86	84	85	82	84	77	84	78	85	84	75	65
112	97	105	109	127	96	100	85	87	91	100	85	82	87	85	93	83	76	83	82	86	71	60
104	105	102	110	107	98	99	99	95	101	100	88	87	87	85	87	79	87	80	88	86	77	66
114	98	106	110	129	97	101	88	88	92	101	86	84	90	88	98	88	74	85	83	87	71	60
104	105	102	110	107	98	98	98	94	102	99	88	86	88	85	88	80	88	80	90	85	76	61
114	98	106	110	129	97	101	88	88	92	101	85	83	89	88	98	87	73	85	83	86	71	60
104	105	102	111	108	98	99	98	94	102	100	88	86	88	85	88	80	87	80	90	86	76	64
116	97	107	111	130	98	102	88	89	93	102	85	84	91	89	98	89	74	86	84	87	72	60
105	106	103	112	108	99	99	99	95	103	100	89	87	88	86	89	82	88	82	91	85	77	63
116	100	108	111	131	99	103	89	90	94	104	87	85	91	90	99	89	75	87	84	88	72	60
105	106	103	112	108	99	100	100	95	103	101	89	87	89	87	89	82	89	82	91	88	77	66
116	100	107	111	131	98	103	88	89	93	102	87	84	91	89	98	88	74	86	84	87	72	60
105	106	102	111	108	99	100	99	95	103	101	88	87	89	85	88	81	88	81	90	87	77	63
115	100	107	112	131	99	103	88	89	93	102	87	84	91	89	98	88	74	86	84	87	72	60
105	106	102	111	108	99	99	98	95	103	100	88	86	88	85	88	80	88	81	90	87	77	62
115	100	107	111	131	99	103	88	89	93	102	87	85	91	89	98	88	74	86	84	86	72	59
105	105	102	111	108	99	99	98	95	103	100	88	86	88	85	88	80	87	81	90	86	77	61

EST DATA:LABORATORY BACK-TO-BACK TEST (SHEET 7)

APERATURE (°C)

4	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	69	70	59	51	45	50	48	34	38	65	55	64	62	76	56	58	45	54	53	46	52	57	57
	81	79	76	57	63	66	49	46	48	76	52	77	77	88	78	57	63	68	60	70	77	70	63
	75	77	64	55	48	54	51	36	41	70	59	70	64	82	59	60	55	57	56	50	56	60	61
	85	84	75	65	64	68	60	61	63	79	63	89	82	91	82	63	66	71	62	74	79	64	60
	82	86	71	60	53	60	56	38	45	77	65	76	67	90	65	66	64	62	61	54	62	65	67
	88	86	77	66	66	71	57	56	58	81	60	82	80	93	84	59	67	72	65	76	82	74	60
	83	87	71	60	53	60	56	38	44	78	66	76	68	91	65	67	62	63	62	55	62	66	68
	90	85	76	61	66	70	50	47	51	80	54	81	79	94	83	59	66	71	63	74	81	74	59
	83	86	71	60	52	60	56	37	44	78	65	76	67	91	65	67	62	63	62	55	62	66	67
	90	86	76	64	66	70	53	52	54	81	57	82	80	94	84	58	66	72	65	75	81	75	60
	84	87	72	60	53	60	66	38	44	78	66	77	67	94	65	67	63	63	62	54	62	66	67
	91	85	77	63	66	69	58	58	63	81	62	82	82	96	84	63	66	72	66	76	81	71	59
	84	88	72	60	53	60	66	37	44	78	66	77	68	93	66	68	63	63	62	55	63	67	67
	91	88	77	66	67	70	60	63	65	81	66	82	84	95	84	59	71	74	66	76	82	74	60
	84	87	72	60	52	59	65	37	44	78	65	77	67	92	65	67	62	63	62	54	64	66	67
	90	87	77	63	66	69	57	60	60	87	60	82	82	95	84	58	66	73	66	76	82	71	59
	84	87	72	60	52	59	66	37	44	78	66	77	67	92	65	67	62	62	61	54	62	66	67
	90	87	77	62	66	69	49	47	49	80	54	82	79	95	84	59	66	75	65	76	81	68	59
	84	86	72	59	53	59	65	37	44	77	65	76	68	92	65	67	63	62	61	54	62	66	67
	90	86	77	61	66	69	49	47	50	81	54	82	79	95	84	59	66	72	64	76	81	75	59

C

K TEST (SHEET 7)

36	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
[illegible]4	62	76	56	58	45	54	53	46	52	57	57	17	21.9		79	44	42	35	21	18
[illegible]7	77	88	78	57	63	68	60	70	77	70	63		21.9	5.2	63	44	36	35		
70	64	82	59	60	55	57	56	50	56	60	61	39	22.2		76	42	42	35	20	18
[illegible]9	82	91	82	63	66	71	62	74	79	64	60		22.2	5.3	63	44	36	34		
76	67	90	65	66	64	62	61	54	62	65	67	16	22.8		73	41	40	34	20	18
82	80	93	84	59	67	72	65	76	82	74	60		22.5	5.3	63	44	36	35		
76	68	91	65	67	62	63	62	55	62	66	68	16	22.5		72	41	38	33	20	18
81	79	94	83	59	66	71	63	74	81	74	59		22.5	5.3	63	44	36	35		
76	67	91	65	67	62	63	62	55	62	66	67	15	22.8		72	41	38	33	20	18
82	80	94	84	58	66	72	65	75	81	75	60		22.5	5.3	63	44	36	35		
77	67	94	65	67	63	63	62	54	62	66	67	14	22.8		72	41	38	33	20	18
82	82	96	84	63	66	72	66	76	81	71	59		22.5	5.3	63	44	36	35		
77	68	93	66	68	63	63	62	55	63	67	67	14	22.8		72	41	38	33	20	18
82	84	95	84	59	71	74	66	76	82	74	60		22.5	5.3	63	44	37	35		
77	67	92	65	67	62	63	62	54	64	66	67	13	22.8		72	41	38	33	20	18
82	82	95	84	58	66	73	66	76	82	71	59		22.5	5.3	63	44	36	35		
77	67	92	65	67	62	62	61	54	62	66	67	14	22.8		72	41	39	33	20	18
82	79	95	84	59	66	75	65	76	81	68	59		22.5	5.3	63	44	36	35		
76	68	92	65	67	63	62	61	54	62	66	67	13	22.8		72	42	39	33	20	18
82	79	95	84	59	66	72	64	76	81	75	59		22.5	5.3	63	44	36	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
12/14/71	02:55	31:28	3000	250	DUMMY	90	103	113	119	100	116	100	108	112	13
					TEST	81	70	110	116	109	105	106	103	112	10
12/14	03:25	31:58	3000	250	DUMMY	92	103	113	119	100	116	100	108	112	13
					TEST	81	70	110	116	109	105	106	103	111	10
						Stop - increase tail load							on power a		
12/14	04:15	32:28	3560	450	DUMMY	91	103	113	119	100	116	100	108	113	13
					TEST	82	72	110	116	109	105	106	103	110	10
						Stop - decrease tail load							on power a		
12/14	05:45	32:58	2400	250	DUMMY	87	99	108	114	93	98	94	101	105	12
					TEST	82	70	109	116	108	104	105	102	110	10
12/14	06:15	33:28	2400	250	DUMMY	91	103	113	119	99	115	100	107	111	1
					TEST	81	70	109	116	108	105	105	102	111	1
12/14	06:45	33:58	2400	250	DUMMY	90	102	112	118	98	113	98	106	109	1
					TEST	80	70	109	115	108	105	105	102	110	1
12/14	07:15	34:28	2700	250	DUMMY	90	102	112	118	98	115	99	107	111	1
					TEST	80	70	109	115	108	105	105	102	110	1
12/14	07:45	34:58	2700	250	DUMMY	90	102	112	118	98	114	99	107	111	1
					TEST	80	69	109	115	108	105	105	102	110	1
12/14	08:15	35:28	3000	250	DUMMY	90	102	113	119	99	115	100	107	111	[illegible]
					TEST	81	70	110	116	109	105	105	102	112	[illegible]
12/14	08:45	35:58	3000	250	DUMMY	91	103	115	121	102	118	102	110	114	[illegible]
					TEST	82	70	110	116	109	105	107	103	112	[illegible]
						Stop inspect strainers									

A

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LAB

TEMPERATURE (°C)

5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
.00	116	100	108	112	131	99	103	89	90	94	103	88	85	91	90	98	99	75	87	84	87	72	60
.09	105	106	103	112	108	99	100	98	96	104	101	89	87	89	87	89	81	89	82	91	87	77	63
.00	116	100	108	112	131	99	103	89	90	93	103	87	84	91	89	98	99	75	87	84	87	72	60
.09	105	106	103	111	108	99	99	98	95	104	101	89	87	89	86	89	81	88	81	91	87	77	63
il load		on power at 03:45																					
.00	116	100	108	113	131	99	103	87	90	94	103	87	85	92	91	99	99	75	88	85	89	73	62
.09	105	106	103	110	109	100	100	99	96	105	101	89	8[illegible]	89	87	91	83	90	83	92	88	77	63
il load		on power at 05:15																					
93	98	94	101	105	123	93	96	83	84	86	95	81	78	83	80	88	78	69	79	77	79	67	56
08	104	105	102	110	108	98	99	99	95	101	100	88	86	88	84	87	79	85	80	87	87	77	62
99	115	100	107	111	129	99	103	88	89	93	102	88	85	90	87	95	85	74	85	84	86	72	60
08	105	105	102	111	108	99	99	99	95	102	100	89	86	89	84	87	79	85	80	87	87	77	64
98	113	98	106	109	128	97	102	87	88	91	101	86	83	89	85	94	84	73	84	82	84	71	57
08	105	105	102	110	108	98	99	99	95	102	100	88	86	89	84	87	79	85	80	87	87	77	63
98	115	99	107	111	130	98	102	88	89	92	101	87	84	90	88	97	87	74	86	83	86	72	59
08	105	105	102	110	108	99	100	100	95	103	100	89	86	90	85	88	81	87	81	90	87	77	62
98	114	99	107	111	130	97	102	88	89	92	101	87	84	90	87	97	86	73	86	83	86	72	59
08	105	105	102	110	108	99	100	99	95	103	100	89	86	90	86	88	81	87	81	91	87	77	61
9	115	100	107	111	130	98	102	88	88	93	102	88	85	91	89	100	89	74	87	84	87	72	60
9	105	105	102	112	109	99	100	100	96	103	100	89	87	90	87	90	81	88	82	91	88	77	62
2	118	102	110	114	132	101	105	91	91	100	105	91	87	96	93	105	93	77	90	87	92	73	61
9	105	107	103	112	109	99	100	100	96	104	101	89	87	90	87	90	83	89	83	91	88	77	62

iners

B

SMISSION TEST DATA:LABORATORY BACK-TO-BACK TEST (SHEET 8)

TEMPERATURE (°C)

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
98	99	75	87	84	87	72	60	53	60	66	37	45	78	66	77	67	93	65	67	63	64	63
89	81	89	82	91	87	77	63	66	69	49	48	51	81	54	82	79	95	84	64	66	72	65
98	99	75	87	84	87	72	60	53	60	66	39	45	78	66	76	68	92	65	67	62	64	63
89	81	88	81	91	87	77	63	66	69	51	48	51	81	54	82	79	95	84	60	66	72	65
99	99	75	88	85	89	73	62	55	62	68	41	47	79	66	78	68	94	67	68	64	65	64
91	83	90	83	92	88	77	63	67	71	53	49	53	81	54	82	79	96	85	60	66	71	64
88	78	69	79	77	79	67	56	49	55	62	36	42	72	61	71	64	86	61	63	56	59	58
87	79	85	80	87	87	77	62	66	69	52	48	51	80	54	81	78	93	82	58	66	72	64
95	85	74	85	84	86	72	60	52	60	56	39	45	78	66	77	68	92	65	67	63	64	63
87	79	85	80	87	87	77	64	66	69	57	57	60	80	57	82	80	94	84	60	67	73	66
94	84	73	84	82	84	71	57	54	58	54	32	43	76	64	75	67	90	63	66	61	62	61
87	79	85	80	87	87	77	63	66	69	57	48	52	81	57	82	81	93	83	64	66	76	65
97	87	74	86	83	86	72	59	52	58	55	37	44	77	64	76	67	91	64	66	62	64	62
88	81	87	81	90	87	77	62	66	70	51	47	50	80	54	82	79	94	84	64	67	72	66
97	86	73	86	83	86	72	59	51	58	55	37	43	77	64	76	67	91	64	66	62	63	62
88	81	87	81	91	87	77	61	66	69	52	47	50	81	54	81	79	94	83	64	67	71	64
100	89	74	87	84	87	72	60	52	59	55	37	44	77	64	76	67	92	64	66	63	64	63
90	81	88	82	91	88	77	62	67	70	52	48	50	81	54	82	79	95	84	59	67	72	64
105	93	77	90	87	92	73	61	52	60	56	38	45	79	66	78	67	96	65	67	66	65	63
90	83	89	83	91	88	77	62	67	70	52	47	51	81	54	82	79	96	84	59	67	72	64

C

(SHEET 8)

39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
65	67	63	64	63	55	62	67	67	14	22.8		72	42	39	33	20	18
84	64	66	72	65	76	82	74	60		22.5	5.3	63	44	36	35		
65	67	62	64	63	55	62	67	68	13	22.8		72	42	39	33	20	18
84	60	66	72	65	75	81	74	60		22.5	5.3	63	44	36	35		
67	68	64	65	64	55	63	67	68	16	22.8		72	42	39	33	20	18
85	60	66	71	64	76	82	74	60		22.5	5.3	63	44	36	33		
61	63	56	59	58	51	58	62	63	15	22.8		76	44	42	35	22	19
82	58	66	72	64	75	81	74	59		22.5	5.3	63	44	37	35		
65	67	63	64	63	55	62	67	68	15	22.8		72	42	41	34	20	18
84	60	67	73	66	77	82	76	60		22.5	5.4	64	44	37	35		
63	66	61	62	61	53	60	65	66	14	22.8		73	42	40	34	20	18
83	64	66	76	65	76	81	74	59		22.5	5.4	63	44	37	35		
64	66	62	64	62	54	61	65	66	13	22.5		73	42	40	34	21	18
84	64	67	72	66	76	81	74	59		22.5	5.4	63	44	36	35		
64	66	62	63	62	54	61	65	66	13	22.8		73	42	40	34	21	18
83	64	67	71	64	76	81	74	59		22.5	5.4	63	44	36	35		
64	66	63	64	63	54	61	65	66	13	22.8		73	42	40	34	21	18
84	59	67	72	64	76	81	74	59		22.5	5.4	63	44	36	35		
65	67	66	65	63	55	63	66	67	13	22.8		72	42	39	33	20	18
84	59	67	72	64	77	81	74	59		22.5	5.4	63	44	36	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9
8/10/72		35:58				Start - on power at 13:15 1 hour test at various powers and cor								
8/11	09:40	37:13	500	250		Start - on power at 09:25 Stop check torque split								
8/11	10:35	37:33	500	250		Start - on power at 10:15 Stop - check torque split								
8/11	20:05	37:53	500	250		Start on power at 19:45 Stop check torque split								
						Start break in run on power at 0								
8/12	08:25	37:53	550	250	DUMMY TEST	97 100	99 72	107 109	109 114	84 104	103 101	89 100	96 96	99 104
8/12	08:55	38:23	550	250	DUMMY TEST	98 98	100 70	110 108	112 112	86 103	107 100	93 101	100 97	102 105
8/12	09:25	38:53	1200	250	DUMMY TEST	94 98	96 71	105 110	108 114	83 106	103 102	90 104	96 99	100 107
8/12	09:55	39:23	1600	250	DUMMY TEST	94 99	95 73	105 112	109 115	84 108	103 104	91 107	97 103	100 110
8/12	10:25	39:55	2000	250	DUMMY TEST	95 99	96 74	106 113	110 117	86 110	106 107	93 109	99 105	102 111
8/12	10:23	40:23	2500	250	DUMMY TEST	96 100	98 76	107 116	112 118	88 113	108 110	95 112	101 108	103 115
						Stop inspect strainers restart on								
8/12	14:30	40:23	1950	250	DUMMY TEST	90 92	93 67	103 104	107 108	81 98	101 93	89 95	94 92	97 96

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA;LABORATORY B

														TEMPERATURE (°C)									
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	3
onditions																							
08:25																							
9	115	87	92	77	80	80	91	75	74	77	68	77	76	70	37	68	69	65	59	54	57	43	57
4	106	96	97	71	93	94	97	87	85	81	75	77	79	71	76	82	82	79	71	71	73	65	60
2	118	91	95	80	80	85	95	81	88	89	71	81	79	72	34	73	74	70	61	54	61	44	58
5	105	96	96	72	93	95	97	89	89	87	80	83	82	75	79	82	90	82	72	72	73	69	68
0	117	85	91	79	78	80	91	75	74	79	71	79	76	74	34	70	70	64	57	51	56	41	54
7	107	98	98	74	94	97	98	90	90	89	85	86	85	79	82	85	93	84	72	73	75	71	69
0	118	87	92	79	78	82	92	76	74	79	73	82	76	76	35	72	72	64	57	51	56	42	54
0	109	100	101	76	96	101	101	93	94	93	90	90	90	82	85	88	96	85	75	76	76	71	71
2	121	89	93	80	80	83	93	78	76	82	78	85	79	81	36	75	74	65	58	52	57	42	55
1	111	102	103	77	98	103	103	95	96	95	94	94	92	85	87	90	99	87	76	77	78	72	73
3	123	91	96	82	82	86	96	80	77	84	83	89	82	85	36	77	76	66	59	53	58	43	56
5	114	105	106	80	101	107	106	98	99	99	98	98	95	88	90	93	105	90	79	80	81	75	75
power at 14:30																							
7	116	84	89	75	75	80	89	76	73	74	68	78	74	71	33	68	71	63	56	50	55	41	54
5	98	89	89	63	85	89	90	80	78	74	70	69	71	65	70	71	80	68	63	63	63	62	60

RATORY BACK-TO-BACK TEST (SHEET 9)

29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER
[illegible]	57	43	57	46	72	65	71	70	79	66	70	49	65	63	56	62	69	66	25	20.7	
[illegible]	73	65	60	63	82	59	81	76	86	83	72	66	68	71	83	85	73	67		22.5	5.5
[illegible]	61	44	58	49	76	66	75	61	82	67	68	59	62	62	55	63	68	67	25	21.9	
[illegible]	73	69	68	71	87	72	87	72	87	89	90	87	85	68	73	76	87	89		22.5	5.5
[illegible]	56	41	54	45	70	62	69	67	80	63	66	50	61	60	53	59	66	63	25	20.7	
[illegible]	75	71	69	71	89	73	89	90	93	90	82	71	74	78	90	90	80	71		22.5	5.5
[illegible]	56	42	54	45	70	62	69	66	81	62	65	51	60	59	53	59	65	63	26	21.0	
[illegible]	76	71	71	73	92	76	93	93	96	93	85	72	78	81	92	93	81	74		22.5	5.6
[illegible]	57	42	55	46	71	63	70	57	83	64	66	52	61	60	54	60	66	64	26	21.0	
[illegible]	78	72	73	74	93	78	95	94	99	95	87	73	80	82	95	96	83	75		22.8	5.6
[illegible]	58	43	56	47	72	64	72	68	86	65	67	53	63	62	55	61	66	65	27	21.9	
[illegible]	81	75	75	77	96	81	98	99	103	99	90	77	82	86	97	99	86	79		22.8	5.6
[illegible]	55	41	54	44	69	60	68	65	78	61	62	51	60	58	51	57	61	62	25	20.7	
[illegible]	63	62	60	63	75	61	75	72	81	76	63	61	61	61	74	79	65	62		22.2	5.4

TEST (SHEET 9)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
70 76	79 86	66 83	70 72	49 66	65 68	63 71	56 83	62 85	69 73	66 67	25	20.7 22.5	5.5	80 65	43 44	42 38	37 37	22	19
61 72	82 87	67 89	68 90	59 87	62 85	62 68	55 73	63 76	68 87	67 89	25	21.9 22.5	5.5	75 65	42 44	40 38	36 36	21	19
67 90	80 93	63 90	66 82	50 71	61 74	60 78	53 90	59 90	66 80	63 71	25	20.7 22.5	5.5	78 64	42 43	40 37	36 35	21	19
66 93	81 96	62 93	65 85	51 72	60 78	59 81	53 92	59 93	65 81	63 74	26	21.0 22.5	5.6	77 64	42 43	40 37	36 35	21	19
57 94	83 99	64 95	66 87	52 73	61 80	60 82	54 95	60 96	66 83	64 75	26	21.0 22.8	5.6	77 64	42 43	40 37	36 35	21	19
68 99	86 103	65 99	67 90	53 77	63 82	62 86	55 97	61 99	66 86	65 79	27	21.9 22.8	5.6	76 64	42 42	40 37	37 35	21	19
65 72	78 81	61 76	62 63	51 61	60 61	58 61	51 74	57 79	61 65	62 62	25	20.7 22.2	5.4	80 65	44 44	42 38	38 36	22	19

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9
8/12/72	15:00	40:53	1950	250	DUMMY TEST	89 98	92 71	101 110	105 113	79 106	99 102	87 104	92 100	96 105
8/12	15:30	41:23	1950	250	DUMMY TEST	90 100	94 72	102 111	106 115	80 107	100 103	87 106	93 101	96 108
8/12	16:00	41:53	1950	250	DUMMY TEST	91 100	95 72	103 111	107 115	81 108	101 103	88 106	94 101	97 109
8/12	16:30	42:23	1950	250	DUMMY TEST	94 100	96 73	103 112	107 115	82 108	101 104	89 106	94 102	98 109
8/12	17:00	42:53	2400	250	DUMMY TEST	95 101	96 74	104 113	109 116	83 110	103 105	90 108	96 103	99 111
8/12	17:30	43:23	2400	250	DUMMY TEST	95 101	96 74	104 113	108 116	83 110	103 106	90 109	96 104	99 111
8/12	18:00	43:53	2700	250	DUMMY TEST	96 102	96 75	105 114	109 117	84 110	104 106	91 109	96 105	100 112
8/12	18:30	44:23	2700	250	DUMMY TEST	96 100	97 74	104 112	109 115	84 109	104 105	91 107	97 103	100 110
8/12	19:00	44:53	3000	250	DUMMY TEST	96 101	97 74	105 113	109 116	85 110	105 105	91 108	97 103	100 110
8/12	19:30	45:23	3000	250	DUMMY TEST	96 101	98 74	105 113	110 116	85 111	105 105	91 108	97 103	100 111
8/12	20:00	45:53	3000	250	DUMMY TEST	96 101	98 74	105 113	110 116	85 111	105 105	91 108	97 103	100 111

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABO

TEMPERATURE (°C)

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
99	87	92	96	113	82	87	75	75	77	87	72	70	75	68	77	72	71	33	65	68	60	54
102	104	100	105	107	97	97	73	93	97	98	90	90	89	85	85	85	78	81	85	93	85	72
100	87	93	96	115	83	88	75	75	78	88	72	70	75	68	78	72	72	34	65	68	60	54
103	106	101	108	108	99	99	74	95	99	100	92	92	91	87	87	86	80	83	85	94	86	73
101	88	94	97	116	83	89	76	76	79	89	73	71	76	69	78	73	73	35	66	69	61	55
103	106	101	109	108	99	99	74	95	99	100	92	92	91	87	88	87	80	83	86	95	86	73
101	89	94	98	116	85	89	76	77	79	89	74	72	76	69	79	73	73	36	66	70	60	55
104	106	102	109	108	99	100	75	95	99	100	92	93	92	88	88	87	80	83	86	95	86	74
103	90	96	99	118	86	91	78	78	81	91	75	73	79	74	82	76	77	36	69	71	61	55
105	108	103	111	110	101	101	76	97	101	102	94	94	94	91	91	89	82	86	87	96	87	75
103	90	96	99	119	86	91	78	78	81	91	75	73	79	74	82	76	77	37	69	71	61	56
106	109	104	111	110	101	101	76	97	102	102	95	95	94	92	92	89	82	86	87	97	87	76
104	91	96	100	120	86	92	79	78	82	91	76	74	80	77	84	77	79	37	71	72	62	56
106	109	105	112	111	102	103	76	98	102	102	95	95	95	93	94	89	83	87	89	99	87	76
104	91	97	100	120	86	92	79	79	82	91	76	74	80	77	84	77	93	37	71	72	62	56
105	107	103	110	109	100	100	75	96	101	101	93	93	93	91	91	87	83	85	87	96	86	73
105	91	97	100	121	87	92	79	79	83	92	76	74	81	79	85	79	81	37	72	72	62	56
105	108	103	110	110	100	101	75	97	102	102	94	94	94	93	93	88	82	86	87	96	86	73
105	91	97	100	121	87	92	80	80	83	92	76	74	81	79	85	79	81	37	72	72	62	56
105	108	103	111	110	101	101	75	97	102	102	94	94	94	93	93	88	82	86	87	96	86	73
105	91	97	100	121	87	92	80	80	83	92	76	74	81	79	85	79	81	37	72	72	62	56
105	108	103	111	110	101	101	75	97	102	102	94	94	94	93	93	88	82	86	87	96	86	73

ST DATA:LABORATORY BACK-TO-BACK TEST (SHEET 10)

'ERATURE (°C)

25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
65	68	60	54	47	52	40	51	43	66	58	65	65	76	59	62	45	59	58	50	55	60	60
85	93	85	72	73	74	71	68	71	88	73	90	90	93	89	80	69	67	71	88	90	72	73
65	68	60	54	48	52	39	51	43	66	58	66	66	77	59	62	45	59	58	50	55	60	60
85	94	86	73	75	75	71	71	72	90	75	92	93	95	91	83	71	80	80	90	92	81	75
66	69	61	55	49	53	41	52	44	67	59	66	66	77	60	62	46	61	59	51	56	60	61
86	95	86	73	75	76	72	71	72	90	76	93	93	95	91	84	71	80	80	90	92	81	75
66	70	60	55	49	53	40	52	44	67	59	66	67	78	60	63	46	59	58	51	56	61	61
86	95	86	74	76	76	72	71	73	91	76	93	93	96	91	84	71	80	80	90	93	82	76
69	71	61	55	49	54	41	53	44	68	60	67	66	80	61	63	47	59	58	52	57	61	61
87	96	87	75	76	77	73	71	73	92	78	94	95	97	93	85	72	81	82	92	94	83	76
69	71	61	56	50	54	41	53	45	68	60	67	66	80	61	63	47	59	58	52	57	61	62
87	97	87	76	76	78	73	72	74	93	79	94	95	98	93	87	74	81	83	93	95	85	78
71	72	62	56	50	54	41	53	45	68	60	67	66	81	61	64	47	59	58	52	57	61	62
89	99	87	76	77	78	73	72	74	93	79	95	96	99	93	87	71	82	82	92	95	83	79
71	72	62	56	50	54	41	53	45	68	60	67	66	81	61	64	47	59	58	52	57	61	62
87	96	86	73	74	75	71	70	72	91	76	93	95	96	92	84	70	81	81	90	93	82	76
72	72	62	56	50	54	41	53	45	68	60	68	66	82	61	65	48	60	59	52	58	61	62
87	96	86	73	74	75	71	70	72	91	76	93	95	96	92	84	70	81	81	90	93	82	76
72	72	62	56	50	54	41	53	45	68	60	68	66	82	61	65	48	60	59	52	58	61	62
87	96	86	73	74	75	71	72	72	92	76	93	96	96	92	84	70	81	81	90	93	82	76
72	72	62	56	50	54	41	53	45	68	60	68	66	82	61	65	48	60	59	52	58	61	62
87	96	86	73	74	75	71	72	72	92	76	93	96	96	92	84	70	81	81	90	93	82	76

...ST (SHEET 10)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
5	76	59	62	45	59	58	50	55	60	60	25	19.8		81	44	42	38	22	19
0	93	89	80	69	67	71	86	90	72	73		22.5	5.5	65	44	38	36		
5	77	59	62	45	59	58	50	55	60	60	25	20.7		81	44	42	38	22	19
3	95	91	83	71	80	80	90	92	81	75		22.8	5.6	65	44	38	35		
5	77	60	62	46	61	59	51	56	60	61	26	20.7		81	44	42	38	22	19
3	95	91	84	71	80	80	90	92	81	75		22.5	5.5	65	43	38	35		
7	78	60	63	46	59	58	51	56	61	61	26	20.7		81	44	42	38	22	19
3	96	91	84	71	80	80	90	93	82	76		22.5	5.5	65	43	38	35		
5	80	61	63	47	59	58	52	57	61	61	26	21.0		81	44	42	38	22	19
5	97	93	85	72	81	82	92	94	83	76		22.8	5.6	65	43	38	35		
5	80	61	63	47	59	58	52	57	61	62	26	21.0		81	44	42	38	22	19
5	98	93	87	74	81	83	93	95	85	78		22.8	5.6	65	43	38	55		
6	81	61	64	47	59	58	52	57	61	62	26	21.0		81	44	42	38	22	19
6	99	93	87	71	82	82	92	95	83	79		22.8	5.6	65	43	38	35		
6	81	61	64	47	59	58	52	57	61	62	26	21.0		81	44	42	38	22	19
5	96	92	84	70	81	81	90	93	82	76		22.8	5.6	65	43	38	35		
6	82	61	65	48	60	59	52	58	61	62	26	21.0		81	44	42	38	22	19
5	96	92	84	70	81	81	90	93	82	76		22.8	5.6	65	43	38	35		
6	82	61	65	48	60	59	52	58	61	62	26	21.0		80	44	42	38	22	19
6	96	92	84	70	81	81	90	93	82	76		22.8	5.6	65	43	38	35		
6	82	61	65	48	60	59	52	58	61	62	26	21.0		80	44	42	38	22	19
6	96	92	84	70	81	81	90	93	82	76		22.8	5.6	65	43	38	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
8/12/72	20:30	46:23	3000	250	DUMMY TEST	96 101	98 74	105 113	110 116	85 111	105 105	91 108	97 103	100 111	12 11
8/12	21:00	46:53	3000	250	DUMMY TEST	96 101	98 75	105 113	110 116	85 111	105 105	91 108	97 103	100 111	12 11
[illegible]	21:30	47:23	3000	250	DUMMY TEST	96 101	98 75	105 113	110 116	85 111	105 105	92 108	98 103	100 111	12 1
8/12	22:00	47:53	3000	250	DUMMY TEST	96 101	98 75	105 113	110 116	84 111	105 105	92 108	98 103	00 111	12 11
[illegible]	2:18	48:11	3000	250	DUMMY TEST	96 101	98 75	105 113	110 116	84 111	105 105	92 108	98 103	100 111	12 11
						Stop change tail load on power at 2									
[illegible]	23:10	48:41	3560	425	DUMMY TEST	97 101	99 75	107 112	111 115	87 109	108 105	94 101	100 103	103 108	12 11
[illegible]12	23:40	49:11	1100	425	DUMMY TEST	97 98	102 72	104 108	108 113	82 104	101 100	88 98	94 97	97 105	11 10
[illegible]/12	23:52	49:23	3700	425	DUMMY TEST	Ran 12 minutes at this power									
						Stop change tail load on power 00:30									
[illegible]	01:00	49:53	1950	250	DUMMY TEST	Stop check facility									
						Start on power at 01:25									
8/13	01:25	49:53	1950	250	DUMMY TEST	74 93	94 69	103 103	108 108	56 98	102 93	89 90	94 91	98 97	11 9
8/13	01:55	50:23	1950	250	DUMMY TEST	75 99	99 72	104 109	109 114	84 105	103 101	90 102	96 99	99 105	11 10

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABO

	TEMPERATURE (°C)																							
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	2
	105	91	97	100	121	87	92	80	80	83	92	76	74	81	79	85	79	81	37	72	72	62	56	[illegible]
	105	108	103	111	110	101	101	75	97	102	102	94	94	94	93	93	88	82	86	87	96	86	73	[illegible]
	105	91	97	100	121	87	92	80	80	83	92	76	74	81	79	85	79	81	37	72	72	62	56	[illegible]
	105	108	103	111	110	101	101	75	97	102	102	94	94	94	93	93	88	82	86	87	96	86	73	[illegible]
	105	92	98	100	121	87	92	80	80	83	92	76	74	81	79	85	79	81	38	72	73	62	56	[illegible]
	105	108	103	111	11	101	101	75	97	102	102	94	94	94	93	93	88	82	86	87	96	86	73	[illegible]
	105	92	98	100	121	87	91	80	80	83	92	76	74	81	79	85	79	81	38	72	73	62	56	[illegible]
	105	108	103	111	110	101	101	75	97	102	102	94	94	94	93	93	88	82	86	87	96	86	73	[illegible]
	105	92	98	100	121	87	91	80	80	83	92	76	74	81	79	85	79	81	38	72	73	62	56	[illegible]
	105	108	103	111	110	101	101	75	97	102	102	94	94	94	93	93	88	82	86	87	96	86	73	[illegible]
ad on power at 22:40																								
	108	94	100	103	123	90	95	82	81	86	95	78	77	85	84	88	83	85	37	76	76	66	60	[illegible]
	105	101	103	108	119	100	100	74	96	103	102	93	94	94	92	93	87	82	86	86	96	85	74	[illegible]
	101	88	94	97	115	84	90	78	77	79	91	75	73	76	66	76	72	68	36	64	68	63	59	[illegible]
	100	98	97	105	106	96	96	71	93	97	98	90	90	87	80	80	80	74	80	82	90	83	73	[illegible]
is power																								
ad on power 00:30																								
1:25																								
	102	89	94	98	116	89	90	77	76	79	90	73	71	81	69	79	73	72	35	67	70	61	56	[illegible]
	93	90	91	97	98	90	90	86	63	90	90	81	81	79	73	74	71	66	73	73	82	73	65	[illegible]
	103	90	96	99	117	86	91	78	78	80	91	74	72	77	78	75	73	73	35	68	70	64	56	[illegible]
	101	102	99	105	105	97	96	71	92	96	97	89	89	88	83	84	89	75	89	81	90	80	71	[illegible]

ORY BACK-TO-BACK TEST (SHEET 11)

0	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS
4	41	53	45	68	60	68	66	82	61	65	48	60	59	52	58	61	62	26	21.0		80
5	71	72	72	92	76	93	96	96	92	84	70	81	81	90	93	82	76		22.8	5.6	65
4	41	53	45	68	60	68	66	82	61	65	48	60	59	52	58	61	62	26	21.0		80
5	71	72	72	92	76	93	96	96	92	84	70	81	81	90	93	82	76		22.8	5.6	65
4	41	54	45	68	61	68	66	82	62	65	48	60	59	52	58	62	62	27	21.0		80
5	71	72	72	92	76	93	96	96	92	84	70	81	81	90	93	82	76		22.8	5.6	65
4	41	54	45	68	61	68	66	82	62	65	48	60	59	52	58	62	62	27	21.0		80
5	71	72	72	92	76	93	96	96	92	84	70	81	81	90	93	82	76		22.8	5.6	65
4	41	54	45	68	61	68	66	82	62	65	48	60	59	52	58	62	62	26	21.0		80
5	71	72	72	92	76	93	96	96	92	84	70	81	81	90	93	82	76		22.8	5.6	65
	43	57	48	73	63	72	69	86	65	67	50	64	63	55	61	65	65	26	21.0		79
	73	73	74	90	76	92	94	97	91	84	68	81	81	89	93	81	75		22.	5.5	65
	43	56	47	71	62	70	68	77	63	66	46	62	61	53	59	63	64	26	20.7		81
	73	72	73	87	73	90	93	91	88	82	66	79	79	85	89	79	72		22.5	5.5	65
	40	52	44	68	59	67	66	78	60	63	46	60	58	51	57	61	61	25	20.7		80
	65	64	65	82	65	82	85	85	82	72	62	65	65	73	65	82	67		21.9	5.2	65
	41	53	44	69	60	68	67	79	61	64	47	70	59	54	57	62	62	25	20.7		80
	68	68		85	71	91	91	87	71	76	76	82	76	82	87	76	76		22.5	5.5	65

O

T (SHEET 11)

38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
82 96	61 92	65 84	48 70	60 81	59 81	52 90	58 93	61 82	62 76	26	21.0 22.8	 5.6	80 65	44 43	42 38	28 35	22	19
82 96	61 92	65 84	48 70	60 81	59 81	52 90	58 93	61 82	62 76	26	21.0 22.8	 5.6	80 65	44 43	42 38	38 35	22	19
82 96	62 92	65 84	48 70	60 81	59 81	52 90	58 93	62 82	62 76	27	21.0 22.8	 5.6	80 65	44 43	42 38	38 35	22	19
82 96	62 92	65 84	48 70	60 81	59 81	52 90	58 93	62 82	62 76	27	21.0 22.8	 5.6	80 65	44 43	42 38	38 35	22	19
82 96	62 92	65 84	48 70	60 81	59 81	52 90	58 93	62 82	62 76	26	21.0 22.8	 5.6	80 65	44 43	42 38	38 35	22	19
86 97	65 91	67 84	50 68	64 81	63 81	55 89	61 93	65 81	65 75	26	21.0 22.	 5.5	79 65	44 44	42 38	38 36	20	19
77 91	63 88	66 82	46 66	62 79	61 79	53 85	59 89	63 79	64 72	26	20.7 22.5	 5.5	81 65	44 44	42 38	38 36	21	19
78 35	60 82	63 72	46 62	60 65	58 65	51 73	57 65	61 82	61 67	25	20.7 21.9	 5.2	80 65	44 44	42 38	37 36	22	19
79 37	61 71	64 76	47 76	70 82	59 76	54 82	57 87	62 76	62 76	25	20.7 22.5	 5.5	80 65	44 44	42 38	37 36	22	19

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1[illegible]
8/13/72	02:05	50:33	1950	250		Stop check facility									
						Start on power at 02:15									
8/13	02:35	50:53	1950	250	DUMMY	74	96	102	106	82	100	87	93	97	[illegible]
					TEST	97	71	110	114	106	101	103	99	105	[illegible]
8/13	03:05	51:23	1950	250	DUMMY	75	97	103	107	84	101	88	94	98	[illegible]
					TEST	98	72	110	114	106	102	104	100	107	[illegible]
8/13	03:35	51:53	1950	250	DUMMY	75	98	104	108	83	102	89	94	98	[illegible]
					TEST	98	72	110	114	106	102	104	100	107	[illegible]
8/13	04:05	52:23	1950	250	DUMMY	75	97	104	108	83	102	89	94	98	[illegible]
						98	71	110	114	106	102	104	100	107	[illegible]
8/13	04:35	52:53	2400	250	DUMMY	74	96	103	107	82	102	89	94	96	[illegible]
					TEST	97	71	110	114	106	102	103	100	107	[illegible]
8/13	05:05	53:23	2400	250	DUMMY	74	97	104	108	83	102	89	96	99	[illegible]
					TEST	98	71	110	114	107	103	103	101	108	[illegible]
8/13	05:35	53:53	2400	250	DUMMY	73	97	104	108	83	103	90	96	99	[illegible]
					TEST	99	71	111	115	107	103	104	101	108	[illegible]
8/13	06:05	54:23	2700	250	DUMMY	74	97	104	108	84	103	90	96	99	[illegible]
					TEST	99	71	111	115	108	103	106	102	109	[illegible]
8/13	06:35	54:53	2700	250	DUMMY	73	97	104	108	84	103	90	96	100	[illegible]
					TEST	98	71	111	115	108	104	106	102	109	[illegible]
8/13	07:05	55:23	2700	250	DUMMY	73	97	104	108	84	103	91	96	99	[illegible]
					TEST	99	71	111	115	108	104	106	102	110	[illegible]

A

TABLE XXI. ROLLER GEAR TRANSMISSION TEST

TEMPERA

3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
:heck facility																						
on power at 02:15																						
102	106	82	100	87	93	97	109	82	88	75	76	78	88	71	69	74	68	78	77	76	33	64
110	114	106	101	103	99	105	106	97	97	71	93	97	98	90	90	89	84	85	81	76	81	80
103	107	84	101	88	94	98	116	84	89	76	76	79	89	72	71	75	68	79	73	72	34	66
110	114	106	102	104	100	107	107	97	97	72	93	97	98	90	90	89	84	85	81	77	81	81
104	108	83	102	89	94	98	117	84	90	74	74	79	90	73	71	76	70	79	74	73	34	66
110	114	106	102	104	100	107	107	97	98	71	93	97	98	90	90	89	84	85	81	77	81	82
104	108	83	102	89	94	98	117	84	90	77	76	79	90	73	71	76	69	79	74	71	33	67
110	114	106	102	104	100	107	107	97	98	71	93	97	98	90	90	89	84	85	81	77	81	82
103	107	82	102	89	94	96	116	85	89	76	76	79	89	73	71	76	71	80	74	73	33	67
110	114	106	102	103	100	107	107	97	97	71	93	97	98	90	90	89	86	86	83	76	81	82
104	108	83	102	89	96	99	118	86	91	77	77	81	91	74	72	77	73	84	76	76	33	68
110	114	107	103	103	101	108	108	98	98	72	94	98	99	91	91	90	87	87	82	78	82	84
104	108	83	103	90	96	99	118	86	91	77	77	81	91	74	72	78	73	83	76	76	32	69
111	115	107	103	104	101	108	108	98	98	72	94	98	99	91	92	90	87	88	82	79	82	85
104	108	84	103	90	96	99	119	86	91	78	77	81	91	74	72	78	73	83	77	78	32	70
111	115	108	103	106	102	109	108	99	99	73	95	100	100	92	92	92	86	90	84	80	83	85
104	108	84	103	90	96	100	119	86	91	78	77	81	91	74	72	78	77	84	77	78	32	70
111	115	108	104	106	102	109	109	99	99	73	95	99	100	92	92	92	90	90	84	80	82	85
104	108	84	103	91	96	99	119	86	91	78	77	82	91	74	72	78	76	83	77	79	31	71
111	115	108	104	106	102	110	109	99	99	73	95	100	100	92	92	91	89	90	85	81	83	85

ON TEST DATA:LABORATORY BACK-TO-BACK TEST (SHEET 12)

TEMPERATURE (°C)

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
76	33	64	68	59	54	47	52	39	51	47	66	58	65	65	76	58	61	73	58	57	49	54	59
76	81	80	90	81	71	71	67	69	74	70	87	71	90	93	92	88	79	71	77	76	84	89	77
72	34	66	68	60	54	47	54	39	51	43	67	58	66	65	77	59	64	44	58	57	50	55	60
77	81	81	90	81	71	72	74	69	74	70	88	73	90	93	93	89	80	71	77	77	85	90	77
73	34	66	70	61	55	48	53	39	52	43	67	59	66	65	78	59	64	45	59	57	50	55	60
77	81	82	91	81	71	72	74	69	74	70	88	72	91	93	93	89	80	72	77	77	83	90	78
1	33	67	69	60	54	48	54	39	51	43	67	59	66	65	78	59	64	45	58	57	50	55	60
7	81	82	91	81	71	72	73	69	74	70	88	72	91	93	93	89	80	72	72	77	83	90	78
3	33	67	69	60	54	47	54	38	51	42	67	58	66	64	78	59	61	45	60	58	49	55	59
6	81	82	91	82	71	71	72	68	74	69	87	71	89	91	93	88	79	72	76	77	85	90	77
6	33	68	70	61	54	47	53	38	51	42	67	58	67	64	79	59	64	46	58	58	50	56	60
8	82	84	93	82	71	73	75	69	74	70	88	74	91	93	94	90	79	73	77	77	84	90	78
6	32	69	70	61	54	46	54	38	51	42	67	58	67	64	79	59	62	46	58	57	49	55	60
9	82	85	93	82	71	73	74	68	74	71	89	73	91	93	95	90	81	73	78	78	83	91	78
[illegible]	32	70	71	61	54	47	54	37	51	41	67	58	67	64	80	59	61	46	59	57	49	55	60
[illegible]	83	85	93	82	72	74	74	70	75	70	89	74	92	93	95	91	81	74	78	78	84	91	79
[illegible]	32	70	71	61	54	47	54	37	51	42	68	58	67	64	80	59	61	46	59	57	49	55	60
[illegible]	82	85	93	85	72	74	74	70	74	71	89	74	92	93	96	91	82	74	79	79	85	91	79
[illegible]	31	71	72	61	54	47	52	37	51	41	68	58	67	64	80	59	61	47	58	57	49	55	60
[illegible]	83	85	94	84	71	74	74	70	74	71	90	74	92	94	95	91	81	74	78	78	85	91	79

0

...ST (SHEET 12)

38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
76	58	61	73	58	57	49	54	59	58	24	20.1		80	44	42	38	22	19
92	88	79	71	77	76	84	89	77	71		22.5	5.5	65	44	38	36		
77	59	64	44	58	57	50	55	60	60	24	20.4		80	44	42	38	22	19
93	89	80	71	77	77	85	90	77	71		22.5	5.5	65	44	38	36		
78	59	64	45	59	57	50	55	60	60	24	20.4		80	44	42	37	22	19
93	89	80	72	77	77	83	90	78	72		22.5	5.5	65	44	38	36		
78	59	64	45	58	57	50	55	60	60	23	20.4		80	44	42	37	22	19
93	89	80	72	72	77	83	90	78	71		22.5	5.5	65	44	38	36		
78	59	61	45	60	58	49	55	59	59	22	20.4		80	44	42	38	22	19
93	88	79	72	76	77	85	90	77	71		22.5	5.5	65	44	38	36		
79	59	64	46	58	58	50	56	60	60	24	20.4		80	44	42	38	22	19
94	90	79	73	77	77	84	90	78	71		22.5	5.5	65	44	38	36		
79	59	62	46	58	57	49	55	60	60	21	20.4		80	44	42	38	22	19
95	90	81	73	78	78	83	91	78	73		22.5	5.5	65	44	38	36		
80	59	61	46	59	57	49	55	60	60	21	20.7		80	44	42	38	22	19
95	91	81	74	78	78	84	91	79	72		22.5	5.5	64	44	38	36		
80	59	61	46	59	57	49	55	60	60	20	20.7		80	44	42	38	22	19
96	91	82	74	79	79	85	91	79	73		22.5	5.5	64	44	38	36		
80	59	61	47	58	57	49	55	60	60	20	20.7		80	44	42	38	22	19
95	91	81	74	78	78	85	91	79	72		22.5	5.5	64	44	38	36		

D

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
8/13/72	07:35	55:53	3000	250	DUMMY TEST	74 98	98 72	105 113	110 115	85 110	105 105	92 103	98 104	101 110	122 110
8/13	08:05	56:23	3000	250	DUMMY TEST	75 100	99 73	107 113	112 116	86 111	107 106	94 107	100 105	103 112	124 111
8/13	08:35	56:53	3000	250	DUMMY TEST	Stop check dummy lube pump									
8/13	10:33	56:56	3000	250		Start on power at 10:30 Stop inspect strainers									

A

TABLE XXI. ROLLER GEAR TRANSMISSION TES

TEMPE

5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
85	105	92	98	101	122	88	93	80	78	84	93	76	74	82	83	87	81	83	32
110	105	103	104	110	110	100	101	74	96	102	102	93	94	94	94	94	87	84	85
86	107	94	100	103	124	89	95	81	80	86	95	77	76	83	84	88	84	83	33
111	106	107	105	112	111	102	102	76	97	103	103	94	95	95	95	95	89	85	86

my lube pump

at 10:30
strainers

RANSMISSION TEST DATA;LABORATORY BACK-TO-BACK TEST (SHEET 18)

TEMPERATURE (°C)

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
83	87	81	83	32	76	75	62	55	48	53	37	52	42	69	59	68	65	83	61	62	48	60	58
94	94	87	84	85	89	97	85	74	76	77	71	71	71	91	75	93	94	99	93	77	71	79	79
84	88	84	83	33	75	76	63	56	48	54	38	52	42	70	61	69	64	85	61	63	49	60	59
95	95	89	85	86	91	99	87	74	76	77	72	71	74	92	77	94	95	99	93	83	71	80	80

SHEET 18)

39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
61	62	48	60	58	51	56	61	61	21	20.7		79	44	42	38	22	18
93	77	71	79	79	89	93	79	74		22.5	5.5	64	44	38	36		
61	63	49	60	59	51	57	62	62	20	19.5		69	38	36	33	19	16
93	83	71	80	80	90	94	80	74		22.5	5.6	64	43	38	36		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
12/4/72	15:20	56:56	1100	250	DUMMY TEST	97 96	115 70	85 109	118 112	91 104	97 106	98 100	107 100	110 96	1 1
12/4	15:50	57:26	1100	250	DUMMY TEST	93 94	105 66	81 103	109 109	81 100	90 101	88 91	97 95	99 92	1 1
12/4	16:20	57:56	1100	250	DUMMY TEST	92 92	105 65	79 104	108 108	79 99	87 100	86 92	94 94	97 91	1
12/4	16:50	58:26	1100	250	DUMMY TEST	92 92	105 65	79 104	108 108	79 99	87 100	85 94	94 94	97 91	1 1
12/4	17:20	58:56	1950	250	DUMMY TEST	92 93	106 66	78 107	111 111	81 101	88 102	89 96	96 96	99 94	1 1
12/4	17:50	59:26	1950	250	DUMMY TEST	92 93	107 65	79 107	110 110	82 101	88 101	89 97	97 96	99 94	1 1
12/4	18:20	59:56	1950	250	DUMMY TEST	92 93	107 66	78 106	111 111	82 101	88 101	90 99	97 96	99 94	1 1
12/4	18:50	60:26	1950	250	DUMMY TEST	92 94	107 66	78 106	111 111	82 101	89 102	90 99	97 96	100 94	1 1
12/4	19:20	60:56	1950	250	DUMMY TEST	93 94	108 66	79 107	111 111	83 102	89 102	90 99	97 97	100 94	1 1
12/4	19:50	61:26	1950	250	DUMMY TEST	93 94	108 66	82 107	112 111	83 102	89 103	90 98	98 97	101 95	1 1
12/4	20:20	61:56	1950	250	DUMMY TEST	93 94	108 66	82 107	112 111	83 102	89 103	90 98	98 97	101 95	1 1

TABLE XXI. ROLLER GEAR TRANSMISSION TEST

TEMPERA

	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
5	118	91	97	98	107	110	128	98	102	82	85	92	102	90	86	85	82	86	81	86	90	8
9	112	104	106	100	100	96	110	96	96	68	92	98	97	86	84	86	81	81	81	82	83	9
1	109	81	90	88	97	99	117	87	92	80	77	81	91	75	74	80	73	76	72	76	80	7
3	109	100	101	91	95	92	101	91	91	64	87	93	92	81	80	80	74	74	75	75	77	8
	108	79	87	86	94	97	114	84	89	77	75	78	89	72	71	74	69	73	67	72	76	7
	108	99	100	92	94	91	99	90	90	63	86	92	92	80	78	78	73	72	73	74	76	8
	108	79	87	85	94	97	114	84	89	76	75	78	89	72	71	74	69	73	67	72	75	7
	108	99	100	94	94	91	100	90	90	73	86	92	92	80	78	78	73	72	73	74	76	8
3	111	81	88	89	96	99	117	86	91	78	76	81	91	74	73	77	75	76	75	77	82	7
	111	101	102	96	96	94	101	92	92	65	87	93	93	82	80	81	79	78	80	80	82	8
	110	82	88	89	97	99	117	86	91	78	76	81	91	74	73	77	75	77	75	77	82	7
	110	101	101	97	96	94	101	92	92	75	87	93	93	82	80	80	79	78	79	80	82	8
	111	82	88	90	97	99	118	86	91	78	77	81	91	74	73	77	75	77	75	77	82	7
	111	101	101	99	96	94	101	92	92	65	87	93	93	82	80	80	79	78	79	80	81	8
	111	82	89	90	97	100	118	87	92	78	77	82	92	74	73	78	75	77	75	77	82	7
	111	101	102	99	96	94	101	92	92	64	88	93	93	82	80	80	79	78	79	80	81	8
	111	83	89	90	97	100	119	87	92	79	78	82	92	74	73	78	75	77	75	78	82	7
	111	102	102	99	97	94	102	92	92	64	88	93	93	82	80	80	79	78	79	80	82	8
	112	83	89	90	98	101	119	87	93	79	78	82	92	75	73	78	75	77	75	78	82	7
	111	102	103	98	97	95	102	92	93	65	88	93	94	82	80	81	79	78	79	81	82	8
	112	83	89	90	98	101	119	87	93	79	78	82	92	75	73	78	75	77	75	78	82	7
	111	102	103	98	97	95	102	92	92	64	88	94	94	82	80	81	79	78	79	81	82	8

TEST DATA:LABORATORY BACK-TO-BACK TEST (SHEET 14)

MPERATURE (°C)

4	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
0	88	80	76	65	66	53	40	53	50	82	70	81	69	89	67	68	67	68	67	57	72	70	69
3	91	84	71	68	69	66	67	65	76	67	82	90	84	72	64	67	68	74	81	71	78	63	62
0	74	70	65	56	56	46	35	46	41	71	62	70	66	79	59	64	48	63	61	51	69	63	61
7	85	78	73	63	66	66	61	63	63	78	64	79	85	85	79	72	62	64	67	71	78	68	60
6	71	65	62	53	53	42	33	43	40	68	58	67	63	75	55	59	46	58	57	47	66	58	58
6	84	77	72	63	66	64	60	62	63	77	63	79	84	85	79	71	60	63	66	70	77	67	60
5	70	65	62	53	53	42	32	43	39	67	58	67	62	75	54	59	45	57	56	47	66	57	58
6	84	76	72	63	64	63	60	62	63	77	63	78	84	85	79	69	60	63	66	70	77	67	59
2	75	71	62	54	54	43	33	44	40	68	59	68	62	78	55	59	47	59	57	48	67	58	59
2	89	82	74	63	66	66	61	63	63	78	64	79	85	88	79	71	63	63	66	71	78	68	60
2	76	71	62	53	54	43	32	43	40	68	59	68	62	78	55	59	48	58	57	48	67	58	58
2	88	82	73	63	66	66	60	63	63	78	63	79	84	88	79	71	62	64	66	71	78	68	60
2	75	71	62	54	54	43	33	44	40	68	59	68	62	78	55	59	48	58	57	48	67	58	58
1	88	82	74	63	66	65	60	63	63	78	64	79	84	88	79	71	63	64	66	71	78	68	60
2	76	71	63	54	54	43	33	44	40	68	59	68	62	78	56	59	48	58	57	48	67	59	59
1	88	82	74	63	66	65	61	63	63	78	64	79	84	88	80	71	63	63	66	71	78	68	60
2	76	71	63	54	54	43	33	44	40	69	59	68	62	79	56	60	48	59	57	48	67	59	59
2	89	82	74	64	66	66	61	63	64	78	64	80	85	88	80	71	63	65	66	72	78	68	60
2	76	71	63	54	53	43	33	44	40	69	59	68	63	79	56	60	48	58	57	48	67	59	59
2	89	82	74	64	66	66	62	63	64	79	64	80	85	89	80	71	63	66	67	72	79	68	61
2	76	71	63	54	53	43	33	44	40	69	59	68	63	79	56	60	48	58	57	48	67	59	59
2	89	82	74	64	66	66	62	63	64	79	64	80	85	89	80	71	63	66	67	72	79	68	61

C

TEST (SHEET 14)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
59	89	67	68	67	68	67	57	72	70	69	20	21.0		67	40	38	35	21	19
34	72	64	67	68	74	81	71	78	63	62		22.8	5.2	65	44	38	35		
56	79	59	64	48	63	61	51	69	63	61	17	19.8		70	43	41	37	21	20
35	85	79	72	62	64	67	71	78	68	60		21.9	5.3	65	44	38	36		
53	75	55	59	46	58	57	47	66	58	58	16	19.2		72	42	41	37	23	22
34	85	79	71	60	63	66	70	77	67	60		21.9	5.2	65	44	39	35		
52	75	54	59	45	57	56	47	66	57	58	16	18.6		72	42	40	36	22	21
34	85	79	69	60	63	66	70	77	67	59		21.9	5.2	65	44	38	36		
52	78	55	59	47	59	57	48	67	58	59	16	18.6		70	41	38	36	22	21
35	88	79	71	63	63	66	71	78	68	60		21.9	5.3	65	44	38	36		
52	78	55	59	48	58	57	48	67	58	58	16	18.9		70	40	39	35	22	21
34	88	79	71	62	64	66	71	78	68	60		22.2	5.3	65	44	38	35		
2	78	55	59	48	58	57	48	67	58	58	16	19.2		69	40	39	35	22	21
4	88	79	71	63	64	66	71	78	68	60		22.2	5.3	65	44	39	35		
2	78	56	59	48	58	57	48	67	59	59	16	19.2		69	40	39	35	22	21
4	88	80	71	63	63	66	71	78	68	60		22.2	5.3	65	44	38	35		
2	79	56	60	48	59	57	48	67	59	59	16	19.2		69	41	39	35	22	21
5	88	80	71	63	65	66	72	78	68	60		22.2	5.3	66	44	38	35		
3	79	56	60	48	58	57	48	67	59	59	16	19.2		69	41	39	35	22	21
5	89	80	71	63	66	67	72	79	68	61		22.2	5.3	66	44	38	35		
3	79	56	60	48	58	57	48	67	59	59	16	19.2		69	41	39	35	22	21
5	89	80	71	63	66	67	72	79	68	61		22.2	5.3	66	44	38	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7
12/4 /72	20:50	62:26	1950	250	DUMMY TEST	94 94	108 66	81 109	112 111	83 102	90 103	91 99
12/4	21:20	62:56	1950	250	DUMMY TEST	94 94	108 66	82 109	112 112	83 102	90 103	91 97
12/4	21:50	63:26	1950	250	DUMMY TEST	94 94	108 66	83 109	112 112	84 102	90 103	91 98
12/4	22:20	63:56	2400	250	DUMMY TEST	94 95	108 68	83 109	113 112	85 104	91 105	92 98
12/4	22:50	64:26	2400	250	DUMMY TEST	94 95	109 67	82 109	113 112	85 104	91 105	93 101
12/4	23:20	64:56	2400	250	DUMMY TEST	94 94	108 68	83 109	113 112	85 104	91 104	93 101
12/4	23:50	65:26	2400	250	DUMMY TEST	94 94	108 68	83 109	113 112	85 104	91 104	93 101
						Stop end of shift						
12/5	09:15	65:26	2400	250	DUMMY TEST	95 95	110 70	83 112	115 115	86 106	92 107	96 97
12/5	09:45	65:56	2400	250	DUMMY TEST	94 96	108 71	82 112	113 115	85 107	92 109	93 99
12/5	10:15	68:26	2700	250	DUMMY TEST	95 97	108 72	83 113	113 116	85 110	95 110	93 103
12/5	10:45	66:56	2700	250	DUMMY TEST	96 97	109 73	84 114	113 116	86 110	93 111	93 106

TABLE XXI. ROLLER GEAR TRANSMISSI[ON]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
MY	94	108	81	112	83	90	91	98	101	119	88	93	79	78	82	93	75	74	78	75	77	76
T	94	66	109	111	102	103	99	97	95	103	93	93	65	88	96	94	83	81	81	79	79	80
MY	94	108	82	112	83	90	91	98	101	119	88	93	79	78	82	93	75	74	78	75	78	75
T	94	66	109	112	102	103	97	97	96	103	93	93	65	88	96	94	83	81	81	79	79	80
MY	94	108	83	112	84	90	91	98	101	119	99	03	80	89	92	03	85	84	89	85	89	85
T	94	66	109	112	102	103	98	97	95	103	93	93	65	88	96	94	83	81	81	79	79	80
MY	94	108	83	113	85	91	92	100	102	121	89	94	80	80	84	94	76	75	80	80	81	81
T	95	68	109	112	104	105	98	99	97	103	94	95	66	90	96	95	84	82	83	83	83	84
MY	94	109	82	113	85	91	93	100	103	122	89	94	81	80	84	94	76	75	80	80	81	81
T	95	67	109	112	104	105	101	99	97	104	94	95	66	90	95	95	84	82	83	83	83	84
MY	94	108	83	113	85	91	93	100	103	122	89	95	81	80	84	94	76	75	80	80	81	81
T	94	68	109	112	104	104	101	99	97	104	94	95	66	90	95	95	84	83	83	83	83	84
MY	94	108	83	113	85	91	93	100	103	122	89	95	81	80	84	94	76	75	80	80	81	81
T	94	68	109	112	104	104	101	99	97	104	94	95	66	90	95	95	84	83	83	83	83	84
	Stop end of shift																					
Y	95	110	83	115	86	92	96	102	104	124	91	96	76	80	87	97	83	80	74	77	80	76
	95	70	112	115	106	107	97	103	100	106	97	97	69	92	98	97	85	82	81	82	81	82
Y	94	108	82	113	85	92	93	100	102	122	90	95	80	80	87	94	77	76	82	82	81	82
	96	71	112	115	107	109	99	103	101	107	99	99	71	95	100	99	88	86	89	88	87	89
Y	95	108	83	113	85	95	93	100	103	123	90	95	81	80	86	95	78	76	83	84	82	85
	97	72	113	116	110	110	103	104	102	109	100	100	72	95	101	100	90	88	90	90	90	92
Y	96	109	84	113	86	93	93	101	104	123	90	96	81	81	86	95	78	77	83	85	83	85
	97	73	114	116	110	111	106	105	103	110	100	101	72	96	101	101	89	88	91	91	91	92

B

ATA:LABORATORY BACK-TO-BACK TEST (SHEET 15)

URE (°C)

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	TC
71 82	63 74	54 64	54 66	43 66	33 61	44 63	40 64	69 79	59 65	68 80	63 85	79 89	56 81	60 71	48 63	58 65	57 68	48 72	67 79	59 68	59 62	16	1 2
71 82	61 74	54 64	54 66	43 66	33 62	44 63	40 64	68 79	57 65	68 80	63 85	79 89	55 81	60 71	48 63	59 65	57 68	48 72	67 79	58 68	59 62	16	1 2
71 82	61 74	54 66	54 66	43 66	33 61	44 63	40 64	68 78	57 64	68 80	63 85	79 89	55 80	59 71	48 63	58 65	57 67	48 72	67 78	58 68	58 61	16	1 2
77 87	62 75	55 65	55 67	44 67	34 63	45 64	41 65	69 79	58 66	69 81	63 85	81 91	56 82	61 74	49 64	59 66	58 69	49 74	67 80	58 69	59 62	16	1 2
77 88	62 76	55 66	54 67	44 66	34 62	45 65	41 66	69 80	57 66	69 82	63 85	82 91	56 82	60 75	49 64	60 66	58 70	49 74	68 80	58 69	59 62	17	1 2
76 88	62 76	55 66	55 67	45 67	34 63	45 64	41 66	69 80	58 66	69 82	63 85	82 91	56 82	60 74	49 64	60 66	59 69	49 74	68 80	59 69	59 62	16	1 2
76 88	62 76	55 66	55 67	45 67	34 63	45 64	41 66	69 80	58 66	69 82	63 85	82 91	56 82	60 74	49 64	60 66	59 69	49 74	68 80	59 69	59 62	16	1 2
76 92	72 85	63 76	62 66	51 69	41 68	51 66	49 67	77 79	65 66	76 79	65 80	84 91	64 81	65 70	74 66	65 64	63 68	55 74	70 79	65 68	66 61	22	2 2
80 91	64 79	57 69	57 71	47 70	37 65	47 68	43 68	70 82	60 68	71 83	65 85	83 94	58 79	63 76	52 68	62 68	60 71	51 77	69 82	61 71	62 63	19	1 2
83 94	65 80	57 70	56 72	46 71	38 66	47 69	43 70	70 84	60 70	70 86	65 89	84 96	58 87	63 78	51 70	62 70	60 74	51 79	70 84	61 73	62 66	19	1 2
82 94	64 81	57 71	57 73	46 72	37 67	47 70	43 71	70 85	60 71	70 87	65 90	84 98	58 87	63 79	52 71	62 70	60 75	51 80	69 85	61 74	62 66	18	1 2

…EST (SHEET 15)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
3 5	79 89	56 81	60 71	48 63	58 65	57 68	48 72	67 79	59 68	59 62	16	19.2 22.2	5.3	69 65	40 44	39 38	35 36	22	21
3 5	79 89	55 81	60 71	48 63	59 65	57 68	48 72	67 79	58 68	59 62	16	19.2 22.2	5.4	70 65	40 44	39 38	35 35	22	21
3 5	79 89	55 80	59 71	48 63	58 65	57 67	48 72	67 78	58 68	58 61	16	19.2 22.2	5.4	69 65	41 44	39 38	35 35	22	21
3 5	81 91	56 82	61 74	49 64	59 66	58 69	49 74	67 80	58 69	59 62	16	19.2 22.2	5.4	68 65	40 44	38 38	35 35	22	21
3 5	82 91	56 82	60 75	49 64	60 66	58 70	49 74	68 80	58 69	59 62	17	19.2 22.2	5.4	68 65	40 44	38 38	35 35	22	21
	82 91	56 82	60 74	49 64	60 66	59 69	49 74	68 80	59 69	59 62	16	19.2 22.2	5.4	68 65	40 44	38 38	35 35	22	21
	82 91	56 82	60 74	49 64	60 66	59 69	49 74	68 80	59 69	59 62	16	19.2 22.2	5.4	68 65	40 44	38 38	35 35	22	21
	84 91	64 81	65 70	74 66	65 64	63 68	55 74	70 79	65 68	66 61	22	20.7 22.2	5.4	68 65	40 44	38 38	35 35	21	20
	83 94	58 79	63 76	52 68	62 68	60 71	51 77	69 82	61 71	62 63	19	19.5 22.2	5.4	68 65	40 44	38 38	35 35	21	20
	84 96	58 87	63 78	51 70	62 70	60 74	51 79	70 84	61 73	62 66	19	19.5 22.5	5.5	68 65	40 44	38 38	35 35	21	20
	84 98	58 87	63 79	52 71	62 70	60 75	51 80	69 85	61 74	62 66	18	19.5 22.5	5.5	68 65	40 43	38 38	35 35	21	20

D

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8
12/5/72	11:15	67:26	1100	250	DUMMY TEST	97	109	84	112	83	91	89	97
						95	71	111	114	105	106	104	102
12/5	11:45	67:56	1100	250	DUMMY TEST	97	108	83	111	82	90	88	97
						95	69	110	113	105	106	97	100
12/5	12:15	68:26	1100	250	DUMMY TEST	97	108	83	111	82	88	87	96
						93	70	110	112	104	105	93	99
12/5	12:45	68:56	1950	250	DUMMY TEST	96	108	83	112	85	91	92	99
						95	71	111	114	106	107	95	101
12/5	13:15	69:26	1950	250	DUMMY TEST	97	109	83	113	86	91	92	100
						95	71	112	116	107	107	96	102
12/5	13:45	69:56	1950	250	DUMMY TEST	97	109	83	112	86	92	92	99
						98	72	112	116	109	109	97	103
12/5	14:15	70:26	1950	250	DUMMY TEST	97	109	84	113	86	92	92	99
						98	73	115	117	110	111	99	105
12/5	14:45	70:56	1950	250	DUMMY TEST	97	110	84	112	87	92	94	101
						98	73	115	118	111	112	100	105
12/5	15:15	71:26	1950	250	DUMMY TEST	97	110	84	113	86	92	93	100
						98	74	115	118	111	112	99	106
12/5	15:45	71:56	1950	250	DUMMY TEST	97	109	84	113	86	92	93	100
						97	72	114	117	110	111	97	106
12/5	16:15	72:26	1950	250	DUMMY TEST	97	108	84	113	85	92	93	100
						98	72	114	117	110	111	98	106

TABLE XXI. ROLLER GEAR TRANSMISSION TE

TEMP

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
109	84	112	83	91	89	97	100	118	87	92	80	79	81	92	75	74	77	71	75	70	75	79
71	111	114	105	106	104	102	98	107	97	97	70	93	100	99	87	85	86	80	80	81	82	82
108	83	111	82	90	88	97	99	116	86	92	78	78	81	91	74	73	76	71	75	70	75	78
69	110	113	105	106	97	100	97	106	96	96	69	92	100	98	86	84	84	79	79	80	81	82
108	83	111	82	88	87	96	99	116	86	91	78	77	80	91	75	72	76	70	75	69	74	77
70	110	112	104	105	93	99	95	103	95	94	68	90	98	96	84	83	83	78	78	78	79	81
108	83	112	85	91	92	99	102	120	89	93	80	80	83	93	76	75	79	76	78	76	78	83
71	111	114	106	107	95	101	100	106	97	97	69	92	100	98	87	85	86	83	83	84	86	86
109	83	113	86	91	92	100	102	121	89	94	81	80	83	94	76	76	80	77	79	77	79	84
71	112	116	107	107	96	102	100	108	99	99	71	94	100	99	88	86	87	85	85	85	87	87
109	83	112	86	92	92	99	102	121	89	94	80	80	84	94	77	76	80	77	79	77	79	85
72	112	116	109	109	97	103	102	109	99	100	72	95	102	100	89	88	88	86	86	86	87	89
109	84	113	86	92	92	99	103	121	90	94	81	80	84	94	76	76	80	77	79	77	79	85
73	115	117	110	111	99	105	105	111	101	102	74	97	104	102	91	90	90	88	88	89	90	91
110	84	112	87	92	94	101	104	122	91	96	82	81	85	95	78	77	81	78	80	78	80	86
73	115	118	111	112	100	105	105	112	103	102	74	98	104	103	92	90	91	89	89	89	91	92
110	84	113	86	92	93	100	104	122	90	95	82	81	85	95	78	77	81	78	80	78	80	85
74	115	118	111	112	99	106	105	112	102	102	75	98	104	103	92	90	91	89	89	89	91	92
109	84	113	86	92	93	100	103	121	89	95	81	80	84	94	77	76	80	77	79	77	79	84
72	114	117	110	111	97	106	103	111	101	102	74	97	104	103	91	90	90	88	88	89	90	91
108	84	113	85	92	93	100	103	121	89	94	81	80	84	94	77	76	80	77	79	77	79	84
72	114	117	110	111	98	106	103	111	101	101	74	98	103	102	91	89	90	88	88	89	90	91

B

A: LABORATORY BACK-TO-BACK TEST (SHEET 16)

°C)

27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	FLO TOTAL R
53	56	56	46	31	46	42	69	58	69	66	78	57	62	48	61	59	59	68	60	61	18	19.2
79	69	70	70	66	68	69	82	69	85	88	92	85	78	68	69	73	78	83	71	65		22.5
62	57	55	45	36	46	42	68	58	69	65	77	57	62	47	60	58	49	67	59	60	13	18.9
79	68	71	71	66	68	68	82	68	85	88	91	85	78	68	68	74	77	82	71	63		22.2
61	55	55	44	36	45	42	68	57	68	63	76	56	61	47	59	58	48	67	58	60	18	19.2
78	68	69	68	64	66	68	81	67	83	87	79	84	77	66	62	73	76	81	77	63		22.2
62	56	55	45	37	46	42	69	58	69	64	80	57	62	49	60	58	50	68	59	61	18	19.2
78	68	70	70	65	67	68	82	68	84	89	93	84	77	68	68	73	77	82	71	64		22.2
62	56	56	46	36	46	43	69	58	69	65	80	57	62	50	61	59	50	69	60	61	18	19.2
80	70	71	71	66	69	70	84	69	85	89	94	85	79	69	69	76	78	84	72	65		22.5
63	57	56	46	37	46	44	70	59	70	64	81	57	62	49	62	60	59	69	60	62	18	19.2
87	71	73	72	67	70	71	85	70	87	89	95	87	80	71	71	77	80	85	76	66		22.5
63	57	56	46	37	47	43	70	59	70	65	81	58	62	50	61	59	50	69	60	62	18	19.2
83	73	76	75	69	74	73	88	73	89	91	98	90	82	73	72	79	82	87	76	67		22.8
64	57	57	46	37	47	44	71	60	71	66	82	58	63	51	62	61	51	70	61	62	18	19.5
84	74	77	76	70	72	74	89	73	90	91	98	90	82	74	73	79	83	88	76	68		22.8
65	58	56	46	37	47	44	70	60	71	66	82	58	63	51	62	60	51	70	61	62	18	19.5
84	73	76	76	68	71	74	89	73	90	91	98	90	89	74	73	79	83	88	76	68		22.5
63	56	56	45	37	47	43	70	59	70	65	81	57	63	50	61	59	50	69	60	62	19	19.5
83	73	76	74	68	71	73	88	72	89	91	96	90	81	73	72	78	82	88	77	68		22.8
63	56	56	45	37	46	43	70	59	70	65	81	58	63	50	61	59	50	69	60	62	18	19.5
83	73	76	74	69	71	73	88	72	90	91	97	90	81	74	74	78	82	87	76	68		22.8

TEST (SHEET 16)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
66	78	57	62	48	61	59	59	68	60	61	18	19.2		68		38	37	21	21
88	92	85	78	68	69	73	78	83	71	65		22.5	5.5	65		39	35		
65	77	57	62	47	60	58	49	67	59	60	13	18.9		69	41	39	35	21	21
88	91	85	78	68	68	74	77	82	71	63		22.2	5.5	65	44	38	35		
63	76	56	61	47	59	58	48	67	58	60	18	19.2		70	41	39	35	22	21
87	79	84	77	66	62	73	76	81	77	63		22.2	5.4	65	44	38	35		
64	80	57	62	49	60	58	50	68	59	61	18	19.2		68	40	38	35	22	21
89	93	84	77	68	68	73	77	82	71	64		22.2	5.5	65	44	38	35		
65	80	57	62	50	61	59	50	69	60	61	18	19.2		68	40	38	35	22	21
89	94	85	79	69	69	76	78	84	72	65		22.5	5.5	65	44	38	35		
64	81	57	62	49	62	60	59	69	60	62	18	19.2		68	40	38	35	22	21
89	95	87	80	71	71	77	80	85	76	66		22.5	5.6	65	43	38	35		
65	81	58	62	50	61	59	50	69	60	62	18	19.2		68	40	38	35	22	21
91	98	90	82	73	72	79	82	87	76	67		22.8	5.6	65	43	38	35		
66	82	58	63	51	62	61	51	70	61	62	18	19.5		68	40	38	35	22	21
91	98	90	82	74	73	79	83	88	76	68		22.8	5.6	65	43	38	35		
66	82	58	63	51	62	60	51	70	61	62	18	19.5		68	40	39	35	22	21
91	98	90	89	74	73	79	83	88	76	68		22.5	5.6	65	43	38	35		
65	81	57	63	50	61	59	50	69	60	62	19	19.5		69	40	38	34	22	21
91	96	90	81	73	72	78	82	88	77	68		22.8	5.6	64	43	37	35		
65	81	58	63	50	61	59	50	69	60	62	18	19.5		72	43	39	36	22	21
91	97	90	81	74	74	78	82	87	76	68		22.8	5.6	64	43	37	35		

TA

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10	11
12/5/72	16:45	72:56	1950	250	DUMMY TEST	97 97	109 73	84 114	113 117	85 110	92 111	92 98	100 106	103 103	121 111	89 101
12/5	17:15	73:26	1950	250	DUMMY TEST	97 97	109 72	84 114	113 117	85 110	92 111	93 98	100 106	102 103	121 111	90 101
12/5	17:45	73:56	2400	250	DUMMY TEST	97 97	108 72	84 113	113 116	86 110	93 111	94 97	101 105	103 103	123 109	91 100
12/5	18:15	74:26	2400	250	DUMMY TEST	98 97	109 72	84 113	113 116	86 109	93 110	94 97	101 105	104 123	123 110	92 100
12/5	18:45	74:56	2400	250	DUMMY TEST	98 97	109 73	84 113	113 116	86 109	93 110	94 97	102 104	104 103	123 109	91 100
12/5	19:15	75:26	2400	250	DUMMY TEST	97 97	109 72	84 113	113 116	87 109	93 110	94 97	101 105	104 103	123 109	91 100
						Stop	walk around inspection								on power a	
12/5	20:05	75:56	2400	250	DUMMY TEST	97 94	108 68	84 108	112 112	85 103	92 101	93 90	101 97	103 96	123 102	90 93
12/5	20:35	76:26	2700	250	DUMMY TEST	97 95	108 69	94 109	113 113	86 105	93 105	94 92	101 99	104 98	124 105	91 95
12/5	21:05	76:56	2700	250	DUMMY TEST	97 95	108 69	84 110	113 114	86 106	93 106	94 94	102 101	104 99	124 106	92 96
12/5	21:35	77 :26	1100	250	DUMMY TEST	97 93	108 68	85 108	111 111	83 102	90 103	89 90	97 97	100 94	118 103	88 93
12/5	22:05	77:56	1100	250	DUMMY TEST	96 92	107 67	84 107	110 110	82 101	89 101	88 88	96 96	99 93	116 102	86 92

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA;LABORATOR

TEMPERATURE (°C)

8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	3
100 106	103 103	121 111	89 101	94 101	81 74	80 99	84 104	94 102	77 91	75 90	80 90	88 88	80 88	88 89	80 90	84 91	78 96	72 92	63 83	56 72	55 76	45 74	3 6
100 106	102 103	121 111	90 101	94 102	81 74	80 97	84 104	94 102	77 91	75 90	80 90	77 88	79 88	77 89	79 90	83 91	78 97	72 92	63 84	56 73	56 76	45 74	37 69
101 105	103 103	123 109	91 100	96 101	82 72	81 96	86 103	95 101	78 90	77 89	82 90	82 90	81 90	82 91	83 92	87 92	80 98	79 93	64 82	57 71	56 74	46 73	36 68
.01 .05	104 123	123 110	92 100	96 101	82 72	81 96	86 103	96 101	78 89	77 88	83 89	82 89	81 89	82 90	83 91	87 92	80 98	78 93	64 82	57 71	56 74	46 73	37 68
02 04	104 103	123 109	91 100	96 101	82 72	81 96	86 103	96 101	78 89	77 88	83 89	82 89	81 89	82 90	83 91	87 92	80 97	79 93	64 81	58 71	56 74	46 72	37 68
01 05	104 103	123 109	91 100	96 101	82 72	81 96	86 103	96 101	78 89	77 88	83 89	82 89	81 89	82 90	83 91	87 92	81 97	79 93	64 81	58 71	56 74	46 72	37 66
	on power at 19:35																						
01 97	103 96	123 102	90 93	95 93	82 64	80 89	85 96	95 94	77 82	76 81	82 82	81 81	81 81	80 82	82 84	87 84	79 91	77 85	64 74	58 64	57 66	47 65	37 60
01 99	104 98	124 105	91 95	96 96	82 67	81 91	86 98	95 96	78 84	77 83	83 83	83 84	82 84	82 85	84 87	88 87	81 93	80 88	64 76	58 66	57 68	46 67	37 63
2 1	104 99	124 106	92 96	96 97	82 67	81 92	86 98	96 97	78 85	77 84	83 85	83 85	82 85	82 86	84 88	88 88	81 94	80 89	64 77	58 67	57 69	47 68	37 63
7 7	100 94	118 103	88 93	92 93	80 65	78 89	81 96	92 95	75 83	74 81	77 81	71 75	75 75	70 76	75 77	79 79	73 88	66 79	62 74	56 65	55 67	45 66	36 62
5 5	99 93	116 102	86 92	91 92	79 64	77 88	80 95	91 93	74 82	73 80	76 80	70 74	74 74	69 74	74 76	78 77	72 85	65 77	61 74	56 65	54 67	44 66	36 62

TORY BACK-TO-BACK TEST (SHEET 17)

30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS
45	37	46	43	70	59	70	65	81	57	62	49	61	59	50	69	60	61	18	19.5		70
74	68	71	74	88	72	89	91	96	90	82	73	72	78	82	87	75	68		22.8	5.6	64
45	37	46	43	70	59	70	65	81	57	62	50	61	59	50	69	60	61	18	19.5		69
74	69	71	73	88	72	89	91	97	90	82	73	73	78	82	87	76	68		22.8	5.6	64
46	36	46	43	70	60	70	65	83	58	63	51	61	60	50	70	61	62	19	19.8		69
73	68	70	71	85	71	88	91	96	88	81	71	71	77	81	85	74	67		22.8	5.6	64
46	37	46	43	70	60	71	65	83	58	63	51	62	60	51	69	60	62	18	19.8		69
73	68	70	71	85	71	88	91	96	88	80	71	71	77	80	85	74	66		22.8	5.6	64
46	37	47	44	70	60	71	65	83	58	63	51	62	60	51	69	60	62	18	19.5		69
72	68	70	71	85	71	88	90	96	88	80	71	70	77	80	85	74	66		22.8	5.6	64
46	37	47	43	70	60	71	64	83	58	63	51	61	60	50	70	61	62	18	19.8		68
72	66	69	71	85	71	88	90	96	88	80	71	69	77	80	85	74	66		22.8	5.6	65
47	37	47	43	70	60	70	66	83	59	63	51	62	60	50	69	61	62	19	19.8		69
65	60	63	64	79	65	80	85	90	80	74	63	65	71	71	78	68	62		22.2	5.4	65
46	37	47	44	71	60	71	66	84	59	63	51	62	60	51	70	61	62	19	19.8		70
67	63	66	66	80	67	82	87	93	82	80	66	66	71	74	80	70	63		22.2	5.4	65
47	37	47	44	70	60	71	66	84	58	63	51	62	60	51	70	61	62	19	19.8		70
68	63	66	67	81	68	84	87	93	84	77	66	67	74	76	81	71	63		22.2	5.4	65
45	36	46	43	69	58	69	65	77	57	62	47	60	59	49	68	59	61	18	19.2		70
66	62	64	66	79	66	82	87	88	82	76	63	66	72	73	79	74	62		22.2	5.4	65
44	36	45	42	68	57	68	64	76	56	61	47	59	58	49	67	59	60	18	19.2		70
56	62	63	65	79	65	81	87	87	80	74	63	65	71	71	79	68	62		22.2	5.4	65

EST (SHEET 17)

7	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
5	81	57	62	49	61	59	50	69	60	61	18	19.5		70	40	39	36	22	21
1	96	90	82	73	72	78	82	87	75	68		22.8	5.6	64	43	37	35		
5	81	57	62	50	61	59	50	69	60	61	18	19.5		69	40	39	35	22	21
1	97	90	82	73	73	78	82	87	76	68		22.8	5.6	64	43	37	35		
5	83	58	63	51	61	60	50	70	61	62	19	19.8		69	40	39	35	22	21
1	96	88	81	71	71	77	81	85	74	67		22.8	5.6	64	43	37	35		
	83	58	63	51	62	60	51	69	60	62	18	19.8		69	40	39	36	22	21
	96	88	80	71	71	77	80	85	74	66		22.8	5.6	64	43	37	35		
	83	58	63	51	62	60	51	69	60	62	18	19.5		69	40	39	35	22	21
	96	88	80	71	70	77	80	85	74	66		22.8	5.6	64	43	38	35		
	83	58	63	51	61	60	50	70	61	62	18	19.8		68	40	39	35	22	21
	96	88	80	71	69	77	80	85	74	66		22.8	5.6	65	43	38	35		
	83	59	63	51	62	60	50	69	61	62	19	19.8		69	41	39	36	22	21
	90	80	74	63	65	71	71	78	68	62		22.2	5.4	65	44	38	36		
	84	59	63	51	62	60	51	70	61	62	19	19.8		70	41	38	36	22	21
	93	82	80	66	66	71	74	80	70	63		22.2	5.4	65	44	38	36		
	84	58	63	51	62	60	51	70	61	62	19	19.8		70	41	39	35	22	21
	93	84	77	66	67	74	76	81	71	63		22.2	5.4	65	44	38	36		
	77	57	62	47	60	59	49	68	59	61	18	19.2		70	40	39	36	22	21
	88	82	76	63	66	72	73	79	74	62		22.2	5.4	65	44	38	36		
	76	56	61	47	59	58	49	67	59	60	18	19.2		70	41	39	36	22	21
	87	80	74	63	65	71	71	79	68	62		22.2	5.4	65	44	38	36		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	
12/5/72	22:35	78:26	1100	250	DUMMY TEST	96 92	107 67	84 106	110 110	82 101	89 101	88 88	96 96	[illegible] [illegible]
12/5	23:05	78:56	1950	250	DUMMY TEST	96 93	107 67	83 108	111 112	84 103	90 103	91 90	99 97	1 9
12/5	23:35	79:26	1950	250	DUMMY TEST	97 94	108 68	84 108	112 112	84 104	91 104	92 91	99 98	1 9
12/6	00:05	79:56	1950	250	DUMMY TEST	97 94	108 68	83 109	111 113	85 104	91 105	92 92	99 99	10 9
12/6	00:35	80:26	1950	250	DUMMY TEST	96 94	108 69	84 109	111 113	85 104	91 104	92 92	98 99	10 9
12/6	01:05	80:56	1950	250	DUMMY TEST	96 94	107 69	84 109	112 113	84 104	91 104	92 92	99 99	10 9
12/6	01:35	81:26	1950	250	DUMMY TEST	97 94	108 69	84 109	112 113	85 104	91 104	92 92	99 99	10 9
12/6	02:05	81:56	1950	250	DUMMY TEST	97 94	108 69	84 109	112 113	85 104	91 104	92 92	99 99	10 9
12/6	02:35	82:26	1950	250	DUMMY TEST	97 94	108 69	84 109	112 113	85 104	91 104	92 92	99 99	10 97
12/6	03:05	82:56	1950	250	DUMMY TEST	97 95	108 69	84 109	114 113	85 104	92 105	92 92	99 99	10 97
12/6	03:35	83:26	1950	250	DUMMY TEST	97 94	108 69	85 109	114 113	85 104	91 104	92 92	99 99	104 97

A

TABLE XXI. ROLLER GEAR TRANSMISSION TEST

TEMPER

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	2:
107	84	110	82	89	88	96	99	116	86	91	78	77	80	91	74	73	75	70	74	69	74	78	7
67	106	110	101	101	88	96	93	101	92	92	64	88	95	93	81	80	80	73	73	74	76	78	8
107	83	111	84	90	91	99	101	119	89	93	80	79	83	93	76	75	79	76	78	75	78	83	7
67	108	112	103	103	90	97	96	103	94	94	65	89	97	95	83	81	81	79	79	80	82	82	8
108	84	112	84	91	92	99	102	120	89	94	81	79	83	94	76	75	80	76	78	75	78	83	7
68	108	112	104	104	91	98	97	104	94	95	66	90	98	96	83	82	82	80	80	80	83	83	9
108	83	111	85	91	92	99	101	120	90	94	81	79	83	93	76	75	80	76	78	75	78	83	77
58	109	113	104	105	92	99	97	105	95	95	66	90	97	95	84	82	82	81	81	80	83	84	91
108	84	111	85	91	92	98	104	120	89	94	81	80	84	94	76	75	80	76	78	75	78	83	77
69	109	113	104	104	92	99	97	104	95	95	66	91	98	96	84	83	82	81	81	81	83	84	91
.07	84	112	84	91	92	99	104	121	89	94	31	79	83	93	76	75	79	76	78	75	78	82	77
69	109	113	104	104	92	99	97	105	95	95	66	91	98	96	84	82	82	81	81	81	83	84	90
.08	84	112	85	91	92	99	104	120	89	94	81	80	83	94	76	75	80	76	78	75	78	83	77
69	109	113	104	104	92	99	97	105	95	95	66	91	98	96	84	83	83	81	81	81	83	84	90
08	84	112	85	91	92	99	104	121	89	94	81	79	83	94	76	75	80	76	79	75	78	84	77
69	109	113	104	104	92	99	97	105	95	95	66	91	98	96	85	82	82	81	80	81	83	84	90
08	84	112	85	91	92	99	104	120	89	94	81	80	83	93	76	75	80	76	78	75	78	83	77
69	109	113	104	104	92	99	97	105	95	95	66	91	98	96	84	82	82	81	80	81	83	84	90
08	84	114	85	92	92	99	104	121	89	94	81	80	84	94	76	75	80	76	78	76	78	84	77
69	109	113	104	105	92	99	97	105	95	95	67	91	98	96	85	83	82	81	81	81	83	84	90
)8	85	114	85	91	92	99	104	121	89	94	81	80	84	94	76	75	80	76	78	75	78	83	78
59	109	113	104	104	92	99	97	105	95	95	67	91	98	96	84	83	82	81	81	81	83	84	90

MISSION TEST DATA: LABORATORY BACK-TO-BACK TEST (SHEET 18)

TEMPERATURE (°C)

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	4
4	69	74	78	72	65	61	56	54	44	36	45	42	67	57	68	64	76	56	61	48	59	58	49	6
3	74	76	78	85	77	74	64	67	66	61	63	64	78	65	81	85	87	80	74	63	65	70	71	7
3	75	78	83	76	71	62	56	55	45	37	46	43	69	58	69	64	80	57	62	49	59	58	49	6
[illegible]	80	82	82	89	82	74	65	68	66	62	64	66	79	66	81	85	90	81	74	63	66	71	73	7
[illegible]	75	78	83	77	72	63	57	56	45	37	46	43	69	58	69	65	80	57	62	49	61	59	50	6
[illegible]	80	83	83	90	84	76	66	69	67	63	66	66	80	66	82	87	91	82	76	64	66	71	74	8
	75	78	83	77	72	63	57	56	45	37	46	43	69	59	69	64	80	57	62	49	60	59	50	6
	80	83	84	91	83	76	66	68	67	63	64	66	80	66	82	87	91	82	76	66	66	71	74	8
	75	78	83	77	72	63	57	56	45	37	46	43	69	59	69	65	80	57	63	51	60	59	50	6
	81	83	84	91	84	76	66	69	66	63	65	66	80	66	82	87	91	82	76	65	66	71	74	8
	75	78	82	77	72	63	58	56	46	37	47	43	69	59	69	64	80	57	63	49	60	59	50	6
	81	83	84	90	83	76	66	68	66	63	66	66	80	66	82	88	90	82	74	64	66	71	74	79
	75	78	83	77	72	63	52	51	46	37	47	44	69	59	70	65	81	58	63	49	61	60	50	68
	81	83	84	90	84	76	66	68	66	63	66	66	80	67	82	88	91	82	74	65	66	71	74	80
	75	78	84	77	72	67	56	51	46	37	46	43	69	59	70	65	81	58	66	50	61	60	50	68
	81	83	84	90	84	76	66	68	67	66	66	66	79	66	82	87	90	82	74	64	66	71	74	80
	75	78	83	77	72	61	57	56	46	37	47	44	69	59	70	65	81	54	63	49	61	59	50	68
	81	83	84	90	84	76	66	69	68	63	66	66	80	66	82	81	90	82	76	64	66	71	74	80
	76	78	84	77	72	63	57	56	46	38	47	45	69	59	70	65	81	57	63	49	61	59	50	68
	81	83	84	90	84	76	66	69	68	63	66	67	80	67	83	88	91	82	75	66	66	71	74	80
	75	78	83	78	72	63	57	56	46	37	47	44	70	59	70	65	80	58	63	49	61	59	50	68
	81	83	84	90	84	76	66	68	68	63	66	66	80	67	82	87	91	82	76	68	66	74	74	80

C

... TEST (SHEET 18)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
64	76	56	61	48	59	58	49	67	59	60	18	19.5		70	41	39	35	22	21
85	87	80	74	63	65	70	71	78	68	62		22.2	5.4	65	44	38	35		
64	80	57	62	49	59	58	49	68	59	61	18	19.1		70	41	39	35	22	21
85	90	81	74	63	66	71	73	79	69	63		22.2	5.4	65	44	38	35		
65	80	57	62	49	61	59	50	68	60	62	18	19.5		70	41	39	35	22	21
87	91	82	76	64	66	71	74	80	70	63		22.2	5.4	65	44	38	35		
64	80	57	62	49	60	59	50	68	60	62	18	19.2		69	40	38	35	22	21
87	91	82	76	66	66	71	74	80	69	63		22.2	5.4	65	44	38	36		
65	80	57	63	51	60	59	50	68	60	61	18	19.5		70	40	39	35	22	21
87	91	82	76	65	66	71	74	80	70	63		22.2	5.4	65	44	38	35		
64	80	57	63	49	60	59	50	68	60	61	19	19.5		70	42	39	35	21	21
88	90	82	74	64	66	71	74	79	70	63		22.2	5.4	64	44	38	35		
65	81	58	63	49	61	60	50	68	60	62	19	19.5		70	40	39	35	22	21
88	91	82	74	65	66	71	74	80	63	65		22.2	5.4	65	44	38	35		
65	81	58	66	50	61	60	50	68	60	62	19	19.5		72	42	39	35	22	21
87	90	82	74.	64	66	71	74	80	69	63		22.2	5.4	64	44	88	35		
65	81	54	63	49	61	59	50	68	60	62	19	19.5		70	40	38	35	22	21
81	90	82	76	64	66	71	74	80	68	63		22.2	5.4	64	44	38	55		
65	81	57	63	49	61	59	50	68	60	62	19	19.5		70	40	38	35	22	21
88	91	82	75	66	66	71	74	80	70	63		22.2	5.4	64	44	38	35		
65	80	58	63	49	61	59	50	68	60	62	20	19.5		70	42	40	36	22	21
87	91	82	76	68	66	74	74	80	71	63		22.2	5.4	64	44	38	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
12/6/72	04:05	83:56	2400	250	DUMMY	98	108	85	116	86	93	94	101	104	123
					TEST	96	70	110	114	105	107	94	101	99	106
12/6	04:35	84:26	2400	280	DUMMY	98	109	85	113	87	94	94	101	104	124
					TEST	96	71	110	115	107	107	96	101	99	106
12/6	05:05	84:56	2400	250	DUMMY	98	109	85	113	84	96	98	101	104	123
					TEST	96	71	110	115	107	107	96	101	99	106
						Stop - Walk Around Inspection On Powe									
12/6	06:05	85:26	2400	250	DUMMY	96	106	85	111	85	92	93	99	102	122
					TEST	95	71	110	114	106	105	97	100	99	106
12/6	06:35	85:56	2400	250	DUMMY	97	108	86	113	86	93	94	101	103	123
					TEST	95	72	110	115	107	107	99	101	99	106
12/6	07:05	86:26	2700	250	DUMMY	98	109	87	114	88	94	95	102	105	130
					TEST	96	72	111	115	107	108	100	102	100	107
12/6	07:35	86:56	2700	250	DUMMY	98	110	87	114	88	94	95	102	105	125
					TEST	97	73	112	116	108	109	101	103	101	108
						Stop - Inspect Strainers On Power @ 0									
12/6	09:30	86:56	1100	250	DUMMY	96	109	84	110	82	88	88	96	98	117
					TEST	92	70	108	112	102	101	94	97	98	102
12/6	10:00	87:26	1100	250	DUMMY	100	114	91	116	90	97	97	106	109	126
					TEST	92	70	112	115	105	107	98	103	100	107
12/6	10:30	87:56	1100	250	DUMMY	97	110	88	112	89	93	91	100	102	120
					TEST	99	76	113	115	109	111	103	103	100	110
						Stop - Inspect Test Sump Fwd. Chip Dete									
12/6	11:15	88:26	1100	250	DUMMY	98	110	88	112	86	92	92	100	103	121
					TEST	95	72	110	112	104	104	92	99	95	104

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA;LABORAT

TEMPERATURE (°C)

7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
94	101	104	123	91	96	88	81	86	95	78	72	82	81	81	81	83	87	80	78	64	69	67
94	101	99	106	96	96	68	92	100	98	96	84	84	84	85	85	87	88	93	88	77	68	70
94	101	104	124	91	96	83	82	86	90	76	74	83	82	82	82	83	88	80	78	64	69	68
96	101	99	106	97	97	68	93	100	98	86	85	85	85	85	86	87	88	93	88	77	68	70
98	101	104	123	92	96	83	82	86	90	78	77	83	82	82	82	83	87	80	79	64	68	60
96	101	99	106	97	97	69	93	100	98	86	85	85	85	85	86	88	88	93	89	77	68	71
nspection On Power @ 05:35																						
93	99	102	122	89	94	80	80	84	94	77	76	80	80	80	79	81	86	79	77	63	68	64
97	100	99	106	96	96	68	92	99	97	86	84	86	84	84	85	87	86	93	88	76	67	71
94	101	103	123	91	95	81	82	85	95	78	76	82	81	81	80	84	87	81	78	64	69	67
99	101	99	106	97	97	69	92	99	98	87	85	87	85	85	86	88	88	93	89	78	68	71
95	102	105	130	93	97	82	82	87	96	79	78	84	84	83	82	85	89	82	82	65	60	59
100	102	100	107	98	99	70	94	100	99	88	87	88	87	88	89	90	90	94	91	78	69	71
95	102	105	125	[illegible]	97	83	82	87	96	79	78	85	88	83	84	85	89	82	82	65	60	58
101	103	101	108	99	99	71	95	102	100	89	88	89	89	89	90	91	91	94	91	79	69	72
iers On Power @ 09:30																						
88	96	98	117	86	91	75	76	81	91	77	72	71	66	72	66	70	74	72	64	69	59	58
94	97	98	102	101	93	66	89	94	95	83	80	80	72	71	72	73	75	78	69	70	62	68
97	106	109	126	98	101	87	86	91	101	88	84	87	81	85	79	86	89	85	77	80	66	66
98	103	100	107	107	99	72	93	98	100	89	87	87	80	81	81	82	84	91	82	78	69	73
91	100	102	120	91	94	81	81	83	94	80	78	81	73	78	72	78	81	77	71	73	61	60
103	103	100	110	109	110	73	96	93	91	90	90	90	83	84	84	86	86	95	87	84	74	79
ump Fwd. Chip Detector On Power @ 10:45																						
92	100	103	121	91	95	81	81	85	95	81	78	81	75	78	73	78	82	78	71	75	62	60
92	99	95	104	103	95	69	91	95	96	85	83	83	76	76	77	79	79	87	79	76	68	71

TA:LABORATORY BACK-TO-BACK TEST (SHEET 19)

E (°C)

27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	FL TOTAL
64	69	67	47	39	48	45	71	60	71	66	83	69	64	61	63	51	52	59	61	63	21	19.5
77	68	70	68	64	66	68	81	68	84	89	93	84	77	66	69	73	77	82	71	66		22.2
64	69	68	47	48	39	45	71	60	71	66	83	69	64	61	62	51	52	59	61	63	21	19.8
77	68	70	69	65	67	68	82	68	85	89	93	85	77	66	69	74	77	82	71	65		22.2
64	68	60	47	39	48	45	70	60	71	66	83	58	64	61	63	51	52	70	61	63	21	19.8
77	68	71	74	65	67	68	82	68	85	89	93	84	77	66	69	74	77	82	72	66		22.2
63	68	64	47	39	48	45	70	59	70	66	84	50	60	60	61	50	51	69	60	63	21	20.4
76	67	71	76	63	66	67	70	67	77	79	92	82	78	67	67	74	76	77	71	63		22.5
64	69	67	48	39	48	45	70	60	72	66	84	59	63	63	63	52	53	61	62	62	21	21.0
78	68	71	76	66	68	69	82	69	84	88	93	84	79	67	69	75	77	82	72	66		22.5
65	60	59	48	40	49	46	71	61	72	67	85	60	63	53	64	62	53	70	62	63	21	19.8
78	69	71	70	66	68	68	82	69	84	89	94	84	77	67	70	74	78	83	72	66		22.5
65	60	58	48	39	50	46	72	61	72	67	85	60	64	53	63	62	52	70	62	63	22	20.1
79	69	72	71	66	69	69	84	70	86	89	95	85	79	68	70	76	78	84	76	66		22.5
69	59	58	48	40	49	47	71	60	71	63	77	60	62	54	62	61	54	69	61	63	23	20.4
70	62	68	65	59	62	64	76	62	76	77	84	77	65	63	59	62	69	76	63	58		22.2
80	66	66	54	43	54	52	81	69	82	72	88	69	72	63	72	71	63	73	70	73	23	22.4
78	69	73	71	67	70	70	83	69	84	87	92	85	77	69	69	74	77	84	72	66		22.5
73	61	60	50	41	50	47	74	63	76	70	81	63	68	53	68	66	58	73	65	68	22	79.8
84	74	79	74	67	74	74	88	71	87	91	95	87	81	69	74	79	80	86	77	69		22.5
75	62	60	50	41	51	48	76	64	77	70	82	65	69	54	69	68	60	72	67	69	23	19.8
76	68	71	69	66	68	69	80	68	82	87	89	81	74	65	69	71	74	80	71	64		22.5

C

ST (SHEET 19)

											PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
											FLOW							
38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
83	69	64	61	63	51	52	59	61	63	21	19.5		69	40	38	38	22	21
93	84	77	66	69	73	77	82	71	66		22.2	5.4	64	44	38	35		
83	69	64	61	62	51	52	59	61	63	21	19.8		68	40	38	35	22	21
93	85	77	66	69	74	77	82	71	65		22.2	5.6						
83	58	64	61	63	51	52	70	61	63	21	19.8		68	40	38	35	22	21
93	84	77	66	69	74	77	82	72	66		22.2	5.5	64	44	38	35		
84	50	60	60	61	50	51	69	60	63	21	20.4		70	42	39	35	21	22
92	82	78	67	67	74	76	77	71	63		22.5	5.5	65	44	38	36		
84	59	63	63	63	52	53	61	62	62	21	21.0		70	42	39	35	21	22
93	84	79	67	69	75	77	82	72	66		22.5	5.5	64	44	38	35		
85	60	63	53	64	62	53	70	62	63	21	19.8		70	42	39	35	21	22
94	84	77	67	70	74	78	83	72	66		22.5	5.5	64	44	38	35		
85	60	64	53	63	62	52	70	62	63	22	20.1		68	41	39	35	22	21
95	85	79	68	70	76	78	84	76	66		22.5	5.6	65	44	38	35		
77	60	62	54	62	61	54	69	61	63	23	20.4		68	40	38	35	22	21
84	77	65	63	59	62	69	76	63	58		22.2	5.4	65	44	38	35		
88	69	72	63	72	71	63	73	70	73	23	22.4		67	40	39	35	22	21
92	85	77	69	69	74	77	84	72	66		22.5	5.5	65	44	38	36		
81	63	68	53	68	66	58	73	65	68	22	79.8		69	40	39	35	22	21
95	87	81	69	74	79	80	86	77	69		22.5	5.6	65	44	38	35		
82	65	69	54	69	68	60	72	67	69	23	19.8		68	38	39	35	22	21
89	81	74	65	69	71	74	80	71	64		22.5	5.6	65	40	38	36		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	
12/6/72	11:45	88:56	1950	250	DUMMY TEST	99 97	111 74	88 111	114 115	89 107	96 108	96 96	103 102	106 100	1 1
12/6	12:15	89:26	1950	250	DUMMY TEST	102 99	111 76	90 112	115 116	91 108	97 110	97 99	110 103	107 101	1 1
12/6	12:45	89:56	1950	250	DUMMY TEST	101 99	113 77	91 113	116 117	91 109	98 110	97 99	106 104	108 102	1 1
						Stop inspect test forward sump ship									
12/6	15:30	90:26	1950	250	DUMMY TEST	100 97	110 75	91 110	116 114	90 105	96 104	96 94	103 100	106 97	1 1
12/6	16:00	90:56	1950	250	DUMMY TEST	100 97	111 74	93 110	115 114	90 106	96 106	95 95	103 101	105 99	1 1
						Stop inspect strainers									
12/6	17:30	91:26	1950	250	DUMMY TEST	99 95	109 74	86 107	112 112	87 102	94 101	93 93	100 97	103 95	1 1
12/6	18:00	91:56	1950	250	DUMMY TEST	100 96	109 75	88 108	112 113	87 103	94 104	93 94	100 98	103 96	12 10
12/6	18:30	92:26	1950	250	DUMMY TEST	100 96	109 75	88 108	113 113	88 103	95 104	94 94	101 98	103 96	12 10
12/6	19:00	92:56	1950	250	DUMMY TEST	100 96	109 75	89 108	113 113	88 103	95 104	94 94	101 98	103 96	12 10
						Stop inspect strainers									
12/6	20:00	93:26	1950	250	DUMMY TEST	99 95	110 74	87 107	112 112	88 102	95 101	93 93	101 97	104 95	12 10
12/6	20:30	93:56	2400	250	DUMMY TEST	100 98	111 76	89 110	114 114	90 105	98 106	96 96	103 100	106 99	12 10

A

TABLE XXI. ROLLER GEAR TRANSMISSION TES

TEMPER

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	2
111	88	114	89	96	96	103	106	124	94	98	84	84	88	98	83	81	85	81	82	80	83	87	8
74	111	115	107	108	96	102	100	107	106	98	71	94	98	99	87	86	87	83	83	84	86	86	9
111	90	115	91	97	97	110	107	127	95	99	85	86	89	98	84	82	86	82	83	83	84	88	8
76	112	116	108	110	99	103	101	109	109	100	72	95	100	100	89	87	88	85	84	85	87	88	9
113	91	116	91	98	97	106	108	127	96	100	86	86	90	99	85	83	87	83	84	83	85	89	8
77	113	117	109	110	99	104	102	110	109	101	73	96	101	101	90	89	89	86	86	86	89	89	9
) inspect test forward sump ship detector																							
.10	91	116	90	96	96	103	106	126	94	97	84	85	88	97	83	81	85	88	83	78	84	87	8
75	110	114	105	104	94	100	97	105	105	96	69	92	97	97	85	81	82	80	80	81	82	83	9
11	93	115	90	96	95	103	105	124	94	98	84	85	87	97	82	80	85	82	81	79	83	86	8
74	110	114	106	106	95	101	99	106	105	97	69	93	98	98	87	84	85	82	82	83	85	85	9
inspect strainers																							
09	86	112	87	94	93	100	103	122	90	95	81	83	84	94	79	76	82	78	79	76	79	84	7
74	107	112	102	101	93	97	95	102	101	93	65	89	95	94	82	80	81	77	77	78	80	81	8
09	88	112	87	94	93	100	103	122	90	95	82	83	85	95	79	77	82	79	79	77	79	84	7
75	108	113	103	104	94	98	96	104	103	95	67	90	96	96	84	82	82	79	79	79	82	83	9
09	88	113	88	95	94	101	103	123	91	96	82	83	85	95	80	78	83	79	80	77	80	84	7
75	108	113	103	104	94	98	96	103	103	95	66	90	96	96	84	82	82	79	79	79	82	83	9
09	89	113	88	95	94	101	103	123	90	96	82	84	85	95	80	78	83	79	80	77	80	85	7
75	108	113	103	104	94	98	96	104	103	95	66	90	96	96	84	82	82	79	79	80	82	83	9
) inspect strainers																							
.0	87	112	88	95	93	101	104	123	91	96	82	83	85	95	80	77	82	79	80	77	79	84	7
4	107	112	102	101	93	97	95	103	102	93	65	89	94	94	81	80	81	77	77	78	79	80	8
1	89	114	90	98	96	103	106	125	93	98	84	85	88	96	82	79	86	84	83	83	84	89	8
6	110	114	105	106	96	100	99	106	105	97	68	92	99	98	85	83	84	83	84	84	86	87	9

B

TEST DATA:LABORATORY BACK-TO-BACK TEST (SHEET 20)

EMPERATURE (°C)

	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	7	82	77	77	63	62	52	43	52	50	78	66	80	73	86	68	71	56	72	70	62	73	69	72
	6	93	86	85	71	74	72	68	71	71	83	71	85	90	93	85	77	68	72	85	77	83	74	67
	8	83	78	79	63	63	53	45	54	51	80	68	82	75	86	70	73	57	73	72	65	74	71	74
	8	93	87	80	72	76	74	69	71	76	84	71	87	91	94	85	80	69	75	77	79	85	75	69
	9	84	79	80	65	63	53	46	54	52	81	69	82	75	87	71	74	58	74	73	66	76	72	75
	9	93	89	80	73	76	75	70	72	73	85	72	88	92	95	87	80	70	76	78	80	85	76	69
	7	83	78	78	65	63	54	46	55	51	78	67	80	73	86	69	73	57	72	70	63	75	69	72
	3	90	82	76	68	70	70	65	67	69	86	68	83	86	91	81	74	66	69	71	74	81	71	64
	6	82	76	76	63	62	53	45	54	50	77	66	78	73	85	68	71	55	71	70	62	73	69	71
	5	92	80	78	70	72	71	66	69	69	82	69	85	90	92	84	79	67	71	74	76	82	74	67
	4	79	73	73	61	60	52	45	52	49	74	64	75	72	83	65	69	51	69	67	60	72	66	68
	1	88	80	72	66	68	67	63	66	66	78	67	81	87	89	79	74	62	69	71	70	78	71	64
	4	79	72	72	61	60	52	44	52	49	74	64	75	72	83	65	69	51	69	67	60	72	66	69
	3	90	82	74	67	69	68	65	66	67	79	68	83	89	90	81	77	63	71	72	72	80	72	66
	4	79	73	73	61	60	52	44	52	48	74	64	76	72	83	65	69	52	70	67	60	72	67	69
	3	90	82	74	67	69	68	65	66	66	79	68	84	90	90	81	77	63	71	73	73	80	73	66
	5	79	73	73	61	60	52	44	52	49	75	64	76	72	83	65	70	52	69	68	61	71	67	69
	3	90	82	74	67	69	68	66	66	67	80	68	84	90	90	82	76	63	71	72	74	80	74	66
	4	79	73	73	61	61	52	44	52	49	74	64	75	71	83	65	69	52	69	67	60	71	66	68
	0	88	79	73	66	68	67	63	66	66	78	66	81	85	88	79	73	62	68	70	71	78	70	64
	9	83	80	75	63	61	53	45	53	50	76	65	77	73	86	66	71	54	70	69	61	72	67	70
	7	93	87	77	68	71	70	66	68	68	81	70	84	90	92	82	77	66	73	74	74	81	74	67

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41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
56	72	70	62	73	69	72	24	20.4		68	40	38	35	22	21
68	72	85	77	83	74	67		22.5	5.6	65	44	38	35		
57	73	72	65	74	71	74	26	20.4		68	40	38	35	22	21
69	75	77	79	85	75	69		22.5	5.6	65	44	38	35		
58	74	73	66	76	72	75	29	20.4		68	40	38	35	22	21
70	76	78	80	85	76	69		22.5	5.6	65	44	38	35		
57	72	70	63	75	69	72	29	20.4		67	40	38	35	22	27
66	69	71	74	81	71	64		22.5	5.5	65	44	38	36		
55	71	70	62	73	69	71	29	20.1		67	40	38	35	22	28
67	71	74	76	82	74	67		22.5	5.5	65	44	38	36		
51	69	67	60	72	66	68	28	19.8		68	40	38	35	22	18
62	69	71	70	78	71	64		22.2	5.4	65	44	38	36		
51	69	67	60	72	66	69	29	19.8		68	40	38	35	22	18
63	71	72	72	80	72	66		22.2	5.4	65	44	38	36		
52	70	67	60	72	67	69	28	20.1		68	40	38	35	22	18
63	71	73	73	80	73	66		22.2	5.4	65	44	38	36		
52	69	68	61	71	67	69	28	19.8		68	40	38	35	22	18
63	71	72	74	80	74	66		22.2	5.4	65	44	38	36		
52	69	67	60	71	66	68	28	19.8		68	40	38	35	22	19
62	68	70	71	78	70	64		22.2	5.4	65	44	38	36		
54	70	69	61	72	67	70	29	19.8		67	40	38	35	22	19
66	73	74	74	81	74	67		22.5	5.5	65	44	38	36		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	
12/6/72	21:00	94:26	2400	250	DUMMY TEST	100 97	111 76	90 110	114 114	90 106	98 106	96 95	104 100	106 99	1 1
12/6	21:30	94:56	2400	250	DUMMY TEST	99 97	110 75	88 110	114 114	89 106	97 106	96 95	103 101	105 99	1 1
12/6	22:00	95:26	2400	250	DUMMY TEST	99 96	110 74	87 109	113 114	89 105	96 105	95 93	103 100	105 98	1 1
						Stop inspect strainers on pow									
12/6	23:10	95:56	2400	250	DUMMY TEST	97 94	107 72	84 109	111 113	85 104	92 103	92 92	99 99	102 97	1 1
12/6	23:40	96:26	2700	250	DUMMY TEST	97 95	108 72	85 110	113 114	86 105	93 106	94 93	101 100	103 98	12 10
12/7	00:10	96:56	2700	250	DUMMY TEST	97 95	108 72	84 110	114 114	87 106	94 106	94 94	101 100	103 99	12 10
12/7	00:40	97:26	1100	250	DUMMY TEST	97 92	108 71	85 107	111 110	83 102	90 102	88 90	97 96	100 94	11 10
12/7	01:10	97:56	1100	250	DUMMY TEST	97 92	108 70	84 107	110 110	82 101	90 101	88 88	97 96	99 93	11 10
12/7	01:40	98:26	1100	250	DUMMY TEST	97 92	108 70	85 106	110 110	82 101	89 101	85 88	96 95	99 92	11 10
						Stop inspect strainers on power s									
12/7	03:20	98:56	1950	250	DUMMY TEST	94 95	106 72	81 112	110 115	82 107	89 109	89 95	97 103	100 100	11 10
12/7	03:50	99:26	1950	250	DUMMY TEST	95 95	108 71	82 110	111 114	84 105	91 106	91 93	96 100	101 98	120 106

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY

																TEMPERATURE (°C)							
8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
04	106	126	94	98	85	85	89	98	82	80	86	85	83	84	85	89	83	81	75	63	62	53	45
00	99	106	105	97	68	92	99	98	85	84	85	84	84	84	86	87	93	88	77	69	71	70	66
03	105	126	94	98	84	84	88	97	82	80	86	85	82	83	84	89	82	80	75	61	60	51	42
01	99	106	105	97	68	92	99	98	85	84	85	84	84	84	86	87	93	88	77	68	71	69	66
03	105	125	93	98	84	84	87	97	81	79	85	84	82	83	84	89	82	79	74	61	59	50	41
00	98	105	104	96	68	92	99	97	84	83	84	83	84	84	86	87	93	87	77	68	70	69	65
on power at 22:40																							
99	102	121	89	94	81	80	84	94	78	75	81	80	79	77	80	84	78	74	70	57	56	47	38
99	97	103	103	95	66	90	97	96	83	81	82	81	81	81	83	84	91	84	74	66	67	67	62
01	103	123	91	96	83	81	86	95	79	76	83	84	81	82	83	88	81	78	71	58	57	47	38
.00	98	106	104	96	67	92	99	97	85	83	85	84	85	85	87	87	93	88	77	67	68	68	63
.01	103	123	91	96	83	81	91	95	79	77	83	84	81	82	83	87	81	79	71	58	52	46	38
.00	99	106	105	96	68	92	100	97	85	84	85	85	85	85	87	87	93	88	77	67	69	68	63
97	100	117	87	92	79	78	81	91	76	73	78	71	74	69	73	78	72	65	69	57	55	45	36
96	94	102	101	93	65	89	94	94	82	81	81	74	74	75	76	78	85	77	74	69	69	66	62
97	99	117	87	91	79	78	81	91	75	73	77	71	74	69	73	74	72	64	68	56	54	44	36
96	93	102	100	93	65	88	93	94	82	81	80	73	73	74	75	77	85	77	74	63	66	66	61
96	99	116	87	91	78	77	80	91	74	72	76	70	72	69	73	77	72	64	68	56	54	44	35
95	92	101	100	92	64	88	93	94	82	80	79	73	73	74	75	77	85	76	73	63	66	65	61
on power at 02:50																							
97	100	118	87	92	78	77	82	91	75	73	78	75	76	73	75	80	75	69	63	55	54	44	35
.03	100	107	107	98	71	94	98	99	88	86	86	83	83	84	86	87	92	85	78	74	71	69	63
96	101	120	88	93	80	79	83	93	77	74	79	76	76	74	76	84	77	71	68	56	54	44	35
.00	98	106	105	97	69	92	98	98	86	85	85	82	82	82	85	86	93	88	81	70	72	72	66

ACK TEST (SHEET 21)

5	36	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMM INPU PRES L/H	R
6	78	73	86	67	71	54	71	70	62	72	68	72	29	20.1		67	40	38	34	22	1
0	84	90	93	83	78	66	73	74	76	82	74	68		22.2	5.4	65	44	38	35		
5	77	72	86	65	70	54	70	68	60	73	67	71	25	19.8		67	40	38	35	22	1
)	84	90	93	82	77	65	71	74	77	81	74	66		22.2	5.4	65	44	38	36		
	77	71	85	65	69	53	69	67	59	74	66	69	23	19.8		67	40	38	35	22	1
)	84	89	93	82	76	65	71	72	75	81	73	65		22.2	5.4	65	44	38	36		
)	72	67	82	60	64	49	64	62	54	70	62	65	21	19.8		70	42	39	35	22	1
	80	85	90	80	73	63	67	70	72	79	70	62		22.2	5.4	65	44	38	35		
	73	68	83	61	65	51	65	63	55	72	63	66	20	19.8		69	40	39	35	22	1
	83	88	93	82	76	65	68	72	74	81	71	64		22.2	5.4	65	44	38	35		
	73	67	83	61	65	50	65	63	56	72	63	66	20	19.8		69	40	39	35	22	1
	83	88	92	82	75	66	68	71	74	80	71	64		22.2	5.4	65	44	38	35		
	71	66	77	58	63	47	63	61	53	69	61	64	19	19.2		70	42	39	35	22	1
	82	88	89	80	72	62	66	68	71	78	69	62		22.2	5.3	65	44	38	35		
	65	76	68	52	68	46	62	61	52	69	60	64	19	19.2		71	42	40	36	22	1
	81	86	87	80	71	61	66	68	71	78	66	61		21.9	5.3	65	44	38	35		
	65	76	65	51	68	46	61	60	52	68	60	63	18	19.2		70	42	42	39	22	1
	80	86	86	79	71	61	65	68	70	78	68	62		21.9	5.3	64	44	38	35		
	69	63	67	61	61	47	60	48	50	68	69	61	18	19.8		70	42	19	35	22	1
	83	86	92	85	74	68	68	76	77	82	71	63		22.5	5.6	64	44	38	35		
	70	54	80	53	62	48	61	59	61	69	60	63	18	19.5		70	41	39	35	22	1
	85	88	94	87	76	69	66	74	79	84	74	66		22.5	5.5	64	44	38	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
12/7/72	04:20	99:56	1950	250	DUMMY TEST	96 95	109 70	83 110	114 114	85 105	92 106	92 92	100 100	103 98	12 10
12/7	04:50	100:26	1950	250	DUMMY TEST	96 94	109 70	83 110	113 114	86 105	93 105	93 92	101 100	103 98	12 10
12/7	05:20	100:56	1950	250	DUMMY TEST	96 94	109 70	88 110	113 114	86 105	93 105	93 92	101 100	103 98	12 10
12/7	05:50	101:26	1950	250	DUMMY TEST	97 94	109 71	83 110	113 114	87 105	93 106	93 92	101 100	104 98	12 10
							Stop - Inspect Strainers					On Power			
12/7	07:10	101:56	1950	250	DUMMY TEST	93 92	105 70	80 109	108 114	80 105	88 105	87 92	94 99	98 97	11 10
12/7	07:40	102:26	1950	250	DUMMY TEST	93 93	105 71	81 110	108 114	81 105	88 106	87 92	95 100	97 98	11 10
12/7	08:10	102:56	1950	250	DUMMY TEST	96 93	112 71	85 111	114 114	88 106	95 108	96 94	104 101	106 100	12 10
12/7	08:40	103:26	1950	250	DUMMY TEST	99 95	113 73	88 112	117 116	91 109	103 110	99 95	108 103	110 102	13 10
12/7	09:10	103:56	2400	250	DUMMY TEST	100 96	114 75	88 115	118 117	92 111	105 113	100 100	109 105	111 104	130 111
12/7	09:30	104:16	2400	250			Stop - Correct Facility Problem Start - On Power at 14:20								
12/7	15:00	104:56	2400	250	DUMMY TEST	96 98	110 76	85 115	114 118	89 112	105 113	97 101	105 106	107 105	127 112

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TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORAT

TEMPERATURE (°C)

	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	92	100	103	122	90	95	81	80	84	94	78	75	81	78	79	74	78	84	78	72	69	52	51
	92	100	98	105	105	96	68	91	97	97	85	84	83	80	80	80	83	84	91	84	77	71	69
	93	101	103	123	91	96	82	80	85	95	78	76	82	79	80	77	79	84	78	72	70	57	55
	92	100	98	105	105	96	68	91	97	98	85	84	84	81	80	81	84	85	91	84	77	71	69
	93	101	103	123	91	96	82	80	85	95	79	76	82	79	78	77	79	84	79	73	70	57	55
	92	100	98	105	105	96	68	91	97	98	85	84	84	81	80	81	84	85	91	84	77	71	69
	93	101	104	123	91	96	82	81	86	95	79	76	82	79	79	77	79	84	79	72	70	57	56
	92	100	98	105	106	96	68	91	98	97	84	84	84	81	80	81	84	84	91	84	77	71	69
ners On Power at 06:40																							
	87	94	98	116	84	89	76	76	79	89	72	70	76	73	73	71	72	78	73	67	62	53	51
	92	99	97	105	104	96	67	91	97	97	84	82	83	81	80	80	83	84	90	82	77	65	68
	87	95	97	116	85	90	77	76	79	89	72	70	76	73	73	71	73	78	73	67	63	53	51
	92	100	98	105	104	96	68	92	98	97	85	84	84	81	81	81	84	85	91	84	77	66	68
	96	104	106	126	95	99	83	82	88	98	83	80	84	82	82	80	83	87	81	76	72	60	58
	94	101	100	106	105	98	70	93	100	99	87	85	85	83	82	82	85	86	92	85	79	68	66
	99	108	110	130	98	102	88	85	92	102	87	84	89	86	87	85	88	92	86	82	78	63	62
	95	103	102	109	108	100	72	95	101	101	89	88	87	85	85	85	87	88	94	88	80	69	71
5	100	109	111	130	100	102	88	86	93	102	88	85	92	89	89	88	90	95	87	87	79	64	63
3	100	105	104	111	110	102	74	97	104	103	91	90	90	90	90	90	92	93	98	93	82	70	74
lity Problem																							
t 14:20																							
5	97	105	107	127	96	99	84	83	89	99	86	85	86	86	84	81	86	90	85	82	83	62	63
3	101	106	105	112	111	104	75	97	104	103	92	90	91	90	90	90	92	92	98	93	82	73	77

BORATORY BACK-TO-BACK TEST (SHEET 22)

																					PUMP	
																					FLOW	
8	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER
i2	51	45	36	46	41	71	60	71	66	81	59	63	50	62	61	53	70	61	64	18	19.8	
'1	69	68	62	66	66	82	67	82	86	91	84	74	66	74	74	76	75	81	74		22.5	5.5
i7	55	45	35	46	41	71	60	72	66	81	59	63	50	62	61	53	71	61	64	18	19.8	
'1	69	68	62	66	66	82	67	82	86	91	84	72	68	75	74	76	71	71	62		22.5	5.5
i7	55	45	35	46	41	71	60	72	65	82	60	63	50	63	61	53	71	61	65	17	19.8	
1	69	67	62	66	66	81	67	82	87	91	84	72	68	74	75	71	71	71	63		22.5	5.5
7	56	45	35	46	41	72	60	72	66	82	60	64	50	63	62	53	62	65	65	17	19.8	
1	69	68	62	66	66	81	69	82	86	91	84	72	66	74	75	76	71	71	63		22.5	5.5
3	51	41	33	42	38	65	54	66	62	76	54	58	43	57	56	47	65	57	59	17	19.2	
5	68	66	60	65	65	80	66	81	85	91	81	73	64	67	69	73	80	70	62		22.2	5.4
3	51	41	32	42	38	65	55	66	63	76	54	58	43	58	56	48	65	57	59	16	19.5	
6	68	67	61	65	65	81	66	82	85	91	82	73	65	68	70	75	81	70	62		22.2	5.4
0	58	47	36	47	42	74	62	75	66	84	62	64	57	64	63	55	72	63	67	18	21.0	
3	66	68	62	66	67	82	68	84	86	93	84	76	67	68	71	77	82	71	63		22.5	5.5
3	62	50	38	50	45	79	67	81	70	88	67	70	60	70	68	60	76	68	73	18	21.0	
)	71	70	63	68	68	84	70	85	88	94	86	76	69	70	72	79	84	73	64		22.5	5.6
'	63	52	39	51	45	81	68	82	72	91	68	71	61	70	69	61	76	69	74	18	24.0	
)	74	72	65	70	70	86	71	87	89	98	88	77	71	70	74	80	86	76	66		22.5	5.6
2	63	51	37	50	43	83	67	85	70	88	73	72	57	79	77	70	79	72	75	20	21.0	
3	77	74	67	71	72	87	71	82	84	98	89	79	73	68	76	81	87	76	67		22.8	5.7

EST (SHEET 22)

7	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
5	81	59	63	50	62	61	53	70	61	64	18	19.8		69	41	39	35	22	19
5	91	84	74	66	74	74	76	75	81	74		22.5	5.5	65	44	38	35		
5	81	59	63	50	62	61	53	71	61	64	18	19.8		69	40	39	35	22	19
5	91	84	72	68	75	74	76	71	71	62		22.5	5.5	64	44	38	35		
5	82	60	63	50	63	61	53	71	61	65	17	19.8		69	40	39	35	18	22
7	91	84	72	68	74	75	71	71	71	63		22.5	5.5	64	44	38	35		
5	82	60	64	50	63	62	53	62	65	65	17	19.8		69	41	39	35	22	19
5	91	84	72	66	74	75	76	71	71	63		22.5	5.5	64	44	38	35		
2	76	54	58	43	57	56	47	65	57	59	17	19.2		73	43	42	37	22	20
5	91	81	73	64	67	69	73	80	70	62		22.2	5.4	65	44	38	35		
3	76	54	58	43	58	56	48	65	57	59	16	19.5		74	43	41	37	23	20
5	91	82	73	65	68	70	75	81	70	62		22.2	5.4	65	43	38	35		
5	84	62	64	57	64	63	55	72	63	67	18	21.0		69	41	39	36	21	19
5	93	84	76	67	68	71	77	82	71	63		22.5	5.5	65	43	38	35		
0	88	67	70	60	70	68	60	76	68	73	18	21.0		68	41	39	36	21	19
3	94	86	76	69	70	72	79	84	73	64		22.5	5.6	65	43	38	35		
2	91	68	71	61	70	69	61	76	69	74	18	24.0		79	48	46	42	24	21
9	98	88	77	71	70	74	80	86	76	66		22.5	5.6	65	43	37	35		
0	88	73	72	57	79	77	70	79	72	75	20	21.0		70	42	40	36	22	19
4	98	89	79	73	68	76	81	87	76	67		22.8	5.7	65	44	38	37		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
12/7/72	15:30	105:26	2400	250	DUMMY TEST	98 99	111 75	86 115	115 117	90 110	106 112	98 100	106 106	108 104	12 11
12/7	16:00	105:56	2400	250	DUMMY TEST	98 98	111 74	86 114	115 117	89 110	106 111	98 99	105 105	107 103	12 11
12/7	16:30	106:26	2700	250	DUMMY TEST	97 98	109 74	84 114	114 117	88 111	108 112	97 100	104 106	106 104	12 11
12/7	17:00	106:56	2700	250	DUMMY TEST	97 98	109 74	84 115	113 117	87 111	109 112	96 100	103 106	105 105	12 11
							Stop - Inspect Strainers						On Power		
12/7	18:10	107:26	1100	250	DUMMY TEST	95 93	107 69	85 110	109 113	83 104	97 104	90 94	98 99	101 96	11 10
12/7	18:40	107:56	1100	250	DUMMY TEST	96 93	109 69	85 110	111 113	84 104	100 106	91 94	99 100	102 96	12 10
12/7	19:10	108:26	1100	250	DUMMY TEST	96 93	109 68	85 109	111 113	84 104	101 106	91 95	99 99	102 96	12 10
12/7	19:40	108:56	1950	250	DUMMY TEST	95 94	109 69	83 111	113 115	86 106	105 108	94 95	102 101	105 99	12 10
12/7	20:10	109:26	1950	250	DUMMY TEST	95 93	109 68	83 110	113 113	86 106	105 107	94 94	102 101	105 98	12 10
12/7	20:40	109:56	1950	250	DUMMY TEST	95 93	109 68	83 110	113 114	86 106	104 107	94 94	102 101	105 99	12 10
12/7	21:10	110 :26	1950	250	DUMMY TEST	94 94	109 69	82 111	112 114	86 107	104 108	94 95	101 101	104 100	12 10

TABLE XXI. ROLLER GEAR TRANSMISSION TEST

TEMPER.

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	2
111	86	115	90	106	98	106	108	128	97	100	86	84	91	100	87	88	88	87	85	84	88	92	8
75	115	117	110	112	100	106	104	111	111	102	74	96	104	103	92	90	91	89	89	90	92	92	9
111	86	115	89	106	98	105	107	128	97	100	86	84	90	100	86	85	88	86	85	84	86	90	8
74	114	117	110	111	99	105	103	110	109	102	73	96	104	103	91	90	90	89	89	90	92	92	9
.09	84	114	88	108	97	104	106	126	95	99	85	83	89	98	84	83	86	87	84	85	86	89	8
74	114	117	111	112	100	106	104	111	110	103	74	97	105	103	92	90	91	91	91	92	94	94	9
.09	84	113	87	109	96	103	105	125	94	98	84	82	88	97	83	80	86	86	83	84	86	88	8
74	115	117	111	112	100	106	105	111	110	103	74	97	105	103	92	91	92	91	91	92	94	94	9
Stop - Inspect Strainers					On Power at 17:40																		
.07	85	109	83	97	90	98	101	118	91	93	79	78	82	93	78	75	79	73	77	70	76	80	7
69	110	113	104	104	94	99	96	104	103	95	67	91	95	96	85	83	82	75	75	77	78	79	8
.09	85	111	84	100	91	99	102	120	91	94	80	79	83	96	78	75	79	74	77	71	76	80	7
69	110	113	104	106	94	100	96	105	104	96	68	92	96	97	86	85	83	77	77	78	79	80	8
.09	85	111	84	101	91	99	102	120	91	94	81	79	83	96	78	75	80	74	77	71	76	80	7
68	109	113	104	106	95	99	96	105	104	96	68	91	96	97	86	85	82	77	77	78	80	80	8
09	83	113	86	105	94	102	105	123	93	97	82	80	86	99	80	77	83	80	80	77	81	86	8
69	111	115	106	108	95	101	99	106	105	98	70	93	99	99	88	86	85	83	82	83	85	86	8
09	83	113	86	105	94	102	105	124	94	97	82	80	86	97	80	77	83	80	80	77	81	86	8
68	110	113	106	107	94	101	98	106	105	97	69	92	99	98	87	86	84	82	82	82	85	85	9
09	83	113	86	104	94	102	105	124	93	97	82	81	86	99	80	78	83	80	81	77	81	86	8
68	110	114	106	107	94	101	99	106	105	97	69	92	99	98	87	86	84	82	82	82	85	85	9
09	82	112	86	104	94	101	104	123	93	96	82	80	86	96	80	77	83	79	79	77	81	85	8
69	111	114	107	108	95	101	100	107	106	98	70	93	99	99	88	87	85	83	83	83	86	86	9

B

TRANSMISSION TEST DATA;LABORATORY BACK-TO-BACK TEST (SHEET 23)

TEMPERATURE (°C)

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	4
88	87	85	84	88	92	86	82	84	62	63	51	37	50	43	85	68	86	72	89	74	74	58	81	7
91	89	89	90	92	92	98	93	82	72	76	74	67	71	71	87	71	90	93	98	89	80	71	71	7
88	86	85	84	86	90	85	82	82	61	62	50	36	49	43	83	67	83	70	88	71	71	57	79	7
90	89	89	90	92	92	97	93	82	71	75	73	66	70	71	87	71	90	92	97	89	74	71	69	7
86	87	84	85	86	89	84	82	79	59	61	49	35	47	42	80	64	81	69	86	69	70	55	76	7
91	91	91	92	94	94	98	94	82	72	76	74	67	71	71	87	71	90	91	99	89	81	72	70	7
86	86	83	84	86	88	83	81	76	59	58	47	34	47	46	76	63	78	67	86	66	66	54	71	6
92	91	91	92	94	94	99	95	82	73	76	74	66	71	72	88	71	91	91	99	90	80	73	70	7
79	73	77	70	76	80	75	68	69	56	58	47	34	45	40	71	59	71	63	80	60	61	53	65	6
82	75	75	77	78	79	88	79	76	66	68	68	62	64	66	80	65	84	85	89	82	74	65	63	7
79	74	77	71	76	80	75	69	70	56	57	46	33	45	40	71	59	72	63	80	60	61	52	65	6
33	77	77	78	79	80	89	80	77	66	69	68	62	65	66	82	66	85	88	90	84	77	66	64	7
30	74	77	71	76	80	75	69	70	56	57	45	32	44	40	71	59	71	62	80	59	60	52	64	6
32	77	77	78	80	80	89	80	77	66	70	68	62	65	66	81	66	85	88	90	84	77	66	65	7
33	80	80	77	81	86	80	75	70	57	58	45	32	45	40	71	60	72	62	83	60	61	54	65	6
35	83	82	83	85	86	89	85	78	68	70	69	63	66	68	83	68	87	89	93	85	77	68	68	7
13	80	80	77	81	86	80	74	69	57	58	46	32	44	40	71	59	71	62	83	59	60	54	64	6
14	82	82	82	85	85	93	86	79	68	70	69	63	66	68	84	68	87	89	93	85	77	68	68	7
3	80	81	77	81	86	80	74	67	57	58	46	32	44	40	71	59	71	61	83	59	60	54	64	6
4	82	82	82	85	85	93	86	79	68	71	69	63	66	68	84	68	87	89	93	86	77	68	67	7
3	79	79	77	81	85	80	74	64	56	57	45	32	44	40	70	59	70	61	82	58	59	53	63	6
5	83	83	83	86	86	93	86	79	68	70	68	63	66	68	84	68	87	89	93	86	77	68	68	7

B

TEST (SHEET 23)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
72	89	74	74	58	81	78	71	81	74	76	19	21.0		70	41	40	36	22	19
93	98	89	80	71	71	77	81	87	76	68		22.8	5.6	65	44	38	35		
70	88	71	71	57	79	77	69	79	72	73	18	21.0		70	41	40	36	22	20
92	97	89	74	71	69	76	81	87	76	67		22.5	5.6	65	44	38	35		
69	86	69	70	55	76	74	66	78	70	71	18	21.0		71	42	40	37	22	19
91	99	89	81	72	70	77	81	87	76	68		22.5	5.6	65	43	38	35		
67	86	66	66	54	71	69	62	77	67	68	17	21.0		71	42	41	37	22	20
91	99	90	80	73	70	77	82	88	76	67		22.5	5.6	65	43	38	35		
63	80	60	61	53	65	63	55	70	61	61	17	22.8		82	49	48	43	25	22
85	89	82	74	65	63	70	68	81	69	63		22.5	5.5	65	44	38	36		
63	80	60	61	52	65	64	55	71	62	62	16	20.4		72	42	41	37	23	20
88	90	84	77	66	64	73	76	82	70	63		22.5	5.5	65	44	38	36		
62	80	59	60	52	64	62	55	70	61	61	15	20.4		72	42	41	37	23	20
88	90	84	77	66	65	73	76	81	69	62		22.2	5.5	65	44	38	36		
62	83	60	61	54	65	63	55	71	62	61	15	20.4		72	42	41	38	23	20
89	93	85	77	68	68	72	77	82	70	63		22.2	5.5	65	44	38	36		
62	83	59	60	54	64	62	54	71	61	61	14	21.0		72	42	41	37	23	20
89	93	85	77	68	68	74	78	84	71	64		22.5	5.6	65	44	38	36		
61	83	59	60	54	64	62	53	71	61	59	15	21.0		72	43	42	37	23	20
89	93	86	77	68	67	73	78	83	70	63		22.5	5.6	65	44	38	36		
61	82	58	59	53	63	62	52	70	60	58	14	21.0		73	43	42	38	23	20
89	93	86	77	68	68	73	77	84	71	63		22.5	5.6	65	44	38	36		

D

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
12/7/72	21:40	110:56	1950	250	DUMMY TEST	95 93	109 68	82 110	112 114	86 106	105 107	94 93	101 100	104 98	12[illegible] 10[illegible]
12/7	22:10	111:26	1950	250	DUMMY TEST	95 94	109 68	82 111	112 114	86 106	106 108	94 95	101 102	104 99	12[illegible] 107
12/7	22:40	111:56	1950	250	DUMMY TEST	94 94	109 69	82 111	112 115	86 107	105 108	94 95	101 101	104 99	123 107
12/7	23:10	112:26	1950	250	DUMMY TEST	94 93	109 69	83 111	113 115	86 107	106 108	95 95	102 102	104 100	123 107
12/7	23:40	112:56	1950	250	DUMMY TEST	94 94	109 69	82 111	112 115	86 107	106 108	94 95	101 101	104 100	123 107
12/8	00:10	113:26	1950	250	DUMMY TEST	94 93	109 69	82 111	112 114	86 106	106 108	95 94	102 101	104 99	123 107
12/8	00:40	113:56	2400	250	DUMMY TEST	94 93	108 69	82 111	112 114	86 106	107 108	95 95	101 102	104 100	123 107
12/8	01:10	114:26	2400	250	DUMMY TEST	94 94	108 69	81 112	112 115	85 108	106 110	94 96	101 103	103 101	123 109
12/8	01:40	114:56	2400	250	DUMMY TEST	93 94	107 69	82 112	111 115	85 108	106 109	94 96	100 103	103 101	122 108
12/8	01:55	115:11	2400	250	DUMMY TEST	93 94	107 69	82 112	111 115	85 108	106 109	94 96	100 103	103 101	122 108
						Stop end of shift									
12/8	05:30	115:11	2400	250	DUMMY TEST	94 96	108 72	82 111	112 115	86 107	106 107	93 96	100 102	103 100	123 107

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY BA

TEMPERATURE (°C)

9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
104	123	93	96	82	80	86	97	79	77	83	80	80	77	81	85	80	74	64	56	57	45	31	44
98	106	105	97	68	92	98	98	87	85	84	81	81	82	85	85	93	86	79	68	70	69	63	66
104	123	93	96	82	80	86	97	79	77	83	80	80	77	81	85	79	74	64	56	57	45	31	44
99	107	106	98	70	95	100	99	88	87	85	83	83	83	86	86	93	86	79	68	70	69	63	66
104	123	93	95	82	80	86	97	79	78	83	80	80	77	81	86	80	74	64	56	57	44	31	44
99	107	106	98	70	93	100	99	88	87	85	83	83	83	86	86	93	86	78	68	70	68	63	66
104	123	93	97	82	80	86	97	79	78	83	80	80	77	81	86	80	74	64	56	57	45	31	44
100	107	106	98	70	93	100	99	88	87	85	83	83	83	86	86	93	85	79	68	70	69	63	66
104	123	93	96	82	80	86	98	80	78	82	80	80	77	81	86	80	74	64	56	57	45	32	4
100	107	106	98	70	93	100	99	88	87	85	83	83	83	86	86	93	86	79	68	70	68	63	66
104	123	93	96	82	80	86	97	79	78	82	80	81	77	81	85	80	74	64	55	57	45	31	4
99	107	106	98	69	93	99	99	88	86	85	82	82	82	86	86	93	86	79	68	70	68	63	6
104	123	93	96	82	80	86	97	79	77	83	82	81	80	83	86	81	78	63	56	56	44	31	4
100	107	106	98	69	93	101	99	88	87	86	85	85	86	88	88	94	90	79	68	71	69	63	6
103	123	92	96	82	80	85	97	78	76	82	81	80	79	82	85	80	76	63	55	56	44	31	4
101	109	108	100	71	94	102	100	89	88	87	86	86	87	89	90	95	90	79	68	71	69	63	6
103	122	92	95	81	79	85	97	77	76	82	81	80	79	82	85	79	75	63	55	56	44	30	4
101	108	107	99	70	94	102	100	89	88	87	86	86	87	89	90	95	90	79	68	71	69	63	6
103	122	92	95	81	79	85	97	77	76	82	81	80	79	82	85	79	75	63	55	56	44	30	4
101	108	107	99	70	94	102	100	89	88	87	86	86	87	89	90	95	90	79	68	71	69	63	6
103	123	92	96	80	80	86	95	77	76	82	82	80	79	82	86	81	78	65	57	59	47	33	4
100	107	106	99	69	93	100	100	87	86	86	85	85	85	87	89	94	89	77	67	70	69	62	6

ACK TEST (SHEET 24)

36	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
72	62	82	55	55	53	63	61	52	70	60	55	14	21.0		73	43	43	37	23	20
87	88	93	85	77	65	65	73	75	84	72	64		22.5	5.6	65	44	38	36		
72	62	82	55	55	53	63	61	52	70	60	55	14	21.0		72	43	42	37	22	20
87	90	93	86	77	65	65	73	75	84	70	63		22.5	5.6	65	44	38	36		
72	60	82	55	55	53	63	61	52	70	60	55	14	21.0		72	43	42	38	23	20
87	88	93	85	77	65	65	73	75	83	72	63		22.5	5.6	65	44	38	36		
72	60	82	55	55	54	63	61	52	70	60	55	14	21.0		72	43	42	38	22	20
87	88	92	85	77	65	65	72	75	84	72	63		22.5	5.6	65	44	38	36		
72	60	82	55	55	54	63	61	52	70	60	55	14	21.0		72	43	42	38	22	20
87	88	93	87	77	65	67	73	75	83	72	63		22.5	5.6	65	44	38	36		
72	62	82	55	55	54	62	60	52	70	60	55	14	21.0		72	43	42	38	22	20
87	88	93	86	77	65	67	74	75	84	70	63		22.5	5.6	65	44	38	36		
72	60	83	57	55	53	63	61	52	69	59	57	14	21.0		72	43	41	37	22	20
88	90	95	87	77	69	65	73	70	84	71	63		22.5	5.6	65	44	38	36		
69	59	82	57	55	52	62	60	50	68	59	57	14	20.7		72	43	41	37	22	20
88	90	95	87	77	69	65	73	79	84	71	63		22.5	5.6	65	43	38	35		
69	59	82	56	57	52	61	60	50	68	58	57	14	20.7		73	43	41	38	22	20
88	90	95	87	77	69	65	73	79	84	71	64		22.5	5.6	65	43	38	35		
69	59	82	56	57	52	61	60	50	68	58	57	14	20.7		73	43	41	38	22	20
88	90	95	87	78	69	68	73	79	84	71	64		22.5	5.6	65	43	38	35		
71	62	83	60	61	53	64	62	52	70	61	60	16	20.7		70	42	40	37	23	20
84	85	93	84	76	66	65	72	75	82	70	62		22.5	5.5	66	44	38	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
12/8/72	06:15	115:56	2400	250	DUMMY TEST	94 93	109 70	82 112	112 115	86 108	107 109	93 95	100 102	103 100	124 107
12/8	06:45	116:26	2700	250	DUMMY TEST	94 95	108 71	82 112	112 116	86 109	108 110	94 95	101 103	103 102	123 109
12/8	07:15	116:56	2700	250	DUMMY TEST	93 95	109 72	82 115	112 117	86 111	109 112	94 99	101 106	104 105	124 111
12/8	08:50	117:26	1100	250	DUMMY TEST	96 92	112 71	86 110	113 114	88 105	109 106	94 95	103 100	105 97	123 105
12/8	09:20	117:56	1100	250	DUMMY TEST	96 92	110 71	87 110	113 113	87 104	109 105	94 96	102 99	105 96	12[illegible] 1[illegible]
12/8	09:50	118:26	1100	250	DUMMY TEST	97 92	111 71	86 109	114 113	87 104	109 105	94 96	102 99	105 96	123 105
12/8	10:20	118:56	1950	250	DUMMY TEST	97 93	111 72	86 111	116 115	90 107	112 109	98 95	105 102	108 100	127 107
12/8	10:50	119:26	1950	250	DUMMY TEST	98 93	112 72	87 111	116 115	90 107	113 109	98 95	106 102	108 100	128 108
12/8	11:20	119:56	1950	250	DUMMY TEST	98 95	113 73	87 112	116 116	91 107	113 109	99 95	107 102	109 101	128 108
12/8	11:50	120:26	1950	250	DUMMY TEST	98 94	113 72	87 112	116 116	91 108	113 109	99 95	106 103	109 101	128 108
12/8	12:20	120:56	1950	250	DUMMY TEST	98 94	113 72	87 112	116 116	91 108	113 109	99 95	106 103	109 101	128 108

A

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA;LAB

TEMPERATURE (°C)

5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
86	107	93	100	103	124	92	96	81	80	86	95	78	76	82	81	81	80	82	86	80	77	64	57
08	109	95	102	100	107	107	99	70	95	101	100	88	87	87	85	86	85	88	89	94	89	79	68
86	108	94	101	103	123	92	96	81	80	86	96	78	77	82	82	81	81	83	87	81	80	63	56
09	110	95	103	102	109	105	100	72	95	102	100	89	88	88	88	88	89	[illegible]	91	96	91	79	69
86	109	94	101	104	124	92	96	82	80	87	96	78	77	83	84	82	82	84	88	81	81	64	56
11	112	99	106	105	111	110	102	74	97	105	103	92	90	90	90	90	91	93	93	99	94	82	71
88	109	94	103	105	123	94	97	83	82	87	97	82	79	83	77	80	74	80	83	80	72	73	60
05	106	95	100	97	105	105	96	69	92	96	97	86	84	85	77	77	79	80	80	90	80	77	68
87	109	94	102	105	123	94	97	82	81	87	97	82	79	83	78	81	75	81	85	80	73	73	59
04	105	96	99	96	104	103	95	69	91	96	97	85	84	84	77	77	78	80	80	90	80	77	68
87	109	94	102	105	123	94	97	82	81	87	97	82	79	83	77	81	75	81	84	80	73	72	59
04	105	96	99	96	105	104	95	69	91	96	97	85	83	83	77	77	78	80	80	89	80	77	68
90	112	98	105	108	127	97	100	86	83	91	100	84	82	88	88	85	82	85	90	85	80	72	61
07	109	95	102	100	107	107	99	70	93	100	100	87	86	87	82	82	83	86	84	93	86	79	69
90	113	98	106	108	128	98	101	86	83	91	100	85	85	88	85	85	82	86	90	85	80	71	61
07	109	95	102	100	108	106	99	70	94	100	100	88	86	87	83	83	84	86	85	92	87	79	69
91	113	99	107	109	128	98	101	87	84	92	101	86	83	88	85	86	83	86	91	86	81	70	61
107	109	95	102	101	108	107	99	71	95	100	100	89	87	88	83	84	84	87	85	93	87	80	70
91	113	99	106	109	128	98	101	86	84	91	101	86	83	88	85	86	83	86	91	86	81	70	61
108	109	95	103	101	108	107	99	71	95	101	100	88	87	87	83	84	84	87	85	93	88	80	71
91	113	99	106	109	128	98	101	86	84	91	101	86	83	88	86	86	83	86	91	86	81	70	62
108	109	95	103	101	108	107	99	71	95	101	100	88	87	87	83	84	84	87	85	93	87	80	70

ST DATA: LABORATORY BACK-TO-BACK TEST (SHEET 25)

RATURE (°C)

25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
80	77	64	57	57	45	32	44	40	70	58	70	61	83	58	58	52	63	60	51	69	60	58	15
94	89	79	68	70	69	62	65	67	83	68	85	88	94	85	77	67	66	73	78	83	71	63	
81	80	63	56	56	45	32	44	39	70	58	69	60	83	57	58	52	62	60	51	69	59	58	14
96	91	79	69	72	70	64	67	68	84	69	87	89	95	87	78	69	67	74	79	84	72	64	
81	81	64	56	57	45	32	44	40	70	58	70	60	83	57	57	54	63	61	52	70	60	58	15
99	94	82	71	75	73	67	69	71	87	71	84	84	99	84	79	73	69	76	82	82	74	66	
80	72	73	60	61	48	35	47	42	75	62	75	63	83	62	63	58	68	66	57	74	63	63	16
90	80	77	68	70	69	62	65	68	81	66	84	86	90	83	74	66	64	70	75	81	75	62	
80	73	73	59	61	48	34	47	42	74	62	74	63	83	62	63	57	67	65	57	74	64	63	16
90	80	77	68	70	69	62	65	68	81	66	84	87	90	83	76	66	66	71	76	81	69	62	
80	73	72	59	61	48	34	47	42	74	62	74	63	83	61	63	57	67	64	56	73	63	63	15
89	80	77	68	70	69	62	66	67	81	66	84	86	90	82	74	66	70	70	76	81	69	62	
85	80	72	61	63	49	35	48	42	76	64	76	64	87	62	65	60	68	66	58	76	64	63	16
93	86	79	69	72	70	63	67	69	82	68	85	87	93	84	77	68	67	73	78	82	76	63	
85	80	71	61	62	49	35	48	43	76	64	76	63	88	62	65	61	68	66	57	76	65	63	16
92	87	79	69	72	70	64	67	69	83	68	85	87	93	85	77	68	68	72	78	83	71	63	
86	81	70	61	63	50	35	49	43	76	63	76	64	88	63	64	61	68	66	58	77	65	63	17
93	87	80	70	73	72	65	68	70	84	68	86	88	94	85	77	69	68	74	79	84	71	64	
86	81	70	61	63	50	35	49	43	76	64	76	64	88	63	64	61	69	67	57	76	65	63	16
93	88	80	71	73	71	66	67	69	84	68	86	89	94	85	77	69	68	74	79	84	71	66	
86	81	70	62	63	51	36	48	43	76	63	76	63	86	63	65	61	68	66	57	76	65	63	17
93	87	80	70	73	72	65	68	70	84	68	86	88	94	86	77	69	68	74	79	84	78	65	

ST (SHEET 25)

											PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
											FLOW		PRESS					
38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER		MAIN	L/H	R/H	L/H	R/H
83	58	58	52	63	60	51	69	60	58	15	20.4		70	42	40	36	23	20
94	85	77	67	66	73	78	83	71	63		22.5	5.5	65	44	38	35		
83	57	58	52	62	60	51	69	59	58	14	20.4		71	42	40	37	23	20
95	87	78	69	67	74	79	84	72	64		22.5	5.6	65	44	38	35		
83	57	57	54	63	61	52	70	60	58	15	20.7		71	42	40	37	23	20
99	84	79	73	69	76	82	82	74	66		22.8	5.7	65	43	38	35		
83	62	63	58	68	66	57	74	63	63	16	21.3		71	42	41	37	22	20
90	83	74	66	64	70	75	81	75	62		22.5	5.5	65	44	38	35		
83	62	63	57	67	65	57	74	64	63	16	21.0		70	42	41	37	22	20
90	83	76	66	66	71	76	81	69	62		22.5	5.5	65	44	38	35		
83	61	63	57	67	64	56	73	63	63	15	21.0		70	42	40	37	22	20
90	82	74	66	70	70	76	81	69	62		22.5	5.5	65	44	38	35		
87	62	65	60	68	66	58	76	64	63	16	21.3		70	42	40	37	21	19
93	84	77	68	67	73	78	82	76	63		22.5	5.6	65	44	38	35		
88	62	65	61	68	66	57	76	65	63	16	21.3		70	42	40	37	21	19
93	85	77	68	68	72	78	83	71	63		22.5	5.6	65	44	38	35		
88	63	64	61	68	66	58	77	65	63	17	21.6		70	42	40	37	21	19
94	85	77	69	68	74	79	84	71	64		22.8	5.6	65	44	38	35		
88	63	64	61	69	67	57	76	65	63	16	21.6		70	42	40	37	21	19
94	85	77	69	68	74	79	84	71	66		22.8	5.6	65	44	38	35		
86	63	65	61	68	66	57	76	65	63	17	21.6		70	42	40	37	21	19
94	86	77	69	68	74	79	84	78	65		22.5	5.6	65	44	38	35		

D

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
12/8/72	12:50	121:26	1950	250	DUMMY TEST	97 95	112 73	87 112	116 115	91 107	113 109	98 95	106 103	109 101	128 108
12/8	13:20	121:56	1950	250	DUMMY TEST	98 95	112 73	87 113	117 116	91 108	113 110	99 96	107 103	99 102	128 109
12/8	13:50	122:26	1950	250	DUMMY TEST	100 95	113 74	87 113	117 116	92 109	114 111	100 97	107 104	110 102	129 110
12/8	14:20	122:56	1950	250	DUMMY TEST	99 96	113 74	88 113	117 117	91 109	113 111	99 97	106 105	109 102	128 110
12/8	14:50	123:26	1950	250	DUMMY TEST	99 96	113 75	89 112	117 117	91 109	113 110	99 97	106 105	109 103	128 110
12/8	15:20	123:56	2400	250	DUMMY TEST	98 96	112 75	89 115	117 118	92 111	115 113	100 100	108 107	110 105	130 112
12/8	15:50	124:26	2400	250	DUMMY TEST	96 97	109 75	86 115	113 117	88 111	109 113	96 99	103 107	105 105	125 112
12/8	16:20	124:56	2400	250	DUMMY TEST	94 97	107 75	85 115	111 118	86 111	107 113	93 99	100 106	103 105	123 111
12/8	16:50	125:26	2400	250	DUMMY TEST	96 98	108 75	85 114	112 117	86 111	107 112	94 99	101 106	104 105	123 112
12/8	17:20	125:56	2400	250	DUMMY TEST	96 97	108 75	85 114	112 117	86 111	108 112	94 99	101 106	104 105	123 112
12/8	17:50	126:26	2700	250	DUMMY TEST	97 98	108 76	85 116	113 118	87 112	109 113	95 100	102 107	104 106	124 112

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY BACI

TEMPERATURE (°C)

9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	3
09	128	98	101	88	84	92	101	85	83	89	85	86	83	87	91	86	81	70	62	63	51	36	48	4
01	108	106	100	71	95	101	100	89	87	88	84	84	85	87	86	93	88	80	70	73	72	66	68	7
09	128	98	101	85	84	92	101	86	84	88	86	86	84	87	92	86	81	71	62	63	51	36	48	4
02	109	107	100	72	95	102	100	90	88	89	85	85	85	88	87	94	89	81	71	74	73	66	69	7
10	129	99	102	85	85	92	102	86	85	89	86	86	84	87	92	87	81	71	62	63	51	37	50	4
02	110	109	101	73	95	102	101	91	88	90	86	86	85	88	87	94	89	81	72	75	73	67	70	7
09	128	98	101	87	84	91	101	85	83	89	85	85	83	86	90	85	81	70	61	63	51	37	49	4
02	110	109	100	73	96	102	101	90	88	90	85	85	86	88	87	94	89	81	72	75	73	66	70	7
09	128	98	101	87	84	91	101	85	83	88	85	85	83	86	91	86	81	70	62	63	51	37	49	4
03	110	110	101	73	96	102	102	91	89	90	86	86	86	89	87	94	89	82	72	76	74	67	70	7
10	130	100	102	86	85	92	101	86	84	90	88	86	87	90	95	88	86	72	62	63	51	37	50	4
05	112	111	103	75	98	105	103	92	91	91	90	90	90	93	93	98	94	82	73	77	74	68	70	7
05	125	95	98	84	82	87	97	80	79	86	84	84	82	84	89	83	81	66	59	60	49	46	48	4
05	112	111	103	75	98	106	104	93	92	93	91	91	91	94	94	99	94	84	74	77	75	68	71	7
03	123	92	95	81	80	85	95	78	76	82	81	81	79	81	85	80	78	64	57	58	47	35	46	4
05	111	110	103	75	98	105	103	92	91	92	90	90	91	93	93	99	94	83	74	77	74	67	71	7
04	123	92	95	82	81	85	95	78	76	82	82	81	79	83	86	80	77	63	57	57	46	34	45	4
05	112	111	102	74	98	105	103	92	91	92	90	90	91	93	92	99	94	84	74	77	75	68	70	7
04	123	92	96	82	81	86	96	78	77	83	83	81	81	83	86	80	78	63	57	57	47	35	46	4
05	112	111	103	74	98	106	103	92	91	92	90	90	91	93	93	99	94	84	74	77	75	68	71	7
04	124	93	96	83	81	87	96	79	77	83	85	83	83	85	88	82	81	64	57	58	47	35	46	1
06	112	111	104	75	99	107	104	93	92	94	92	92	93	95	95	100	96	84	74	78	76	69	71	7

b

ATA: LABORATORY BACK-TO-BACK TEST SHEET

(SHEET 26)

38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
38	63	65	61	68	66	56	76	65	63	17	21.6		70	42	40	37	21	19
94	85	77	69	68	74	79	84	71	65		22.8	5.6	65	44	38	35		
38	63	64	62	69	67	57	76	65	63	17	21.6		70	42	40	37	21	19
95	87	78	70	69	74	80	84	73	66		22.8	5.6	65	44	38	35		
39	63	66	62	69	67	57	77	66	64	18	21.6		69	42	40	37	21	19
5	87	79	71	70	75	81	85	74	66		22.8	5.6	65	44	38	35		
7	63	66	60	68	67	56	75	64	63	18	21.3		69	42	40	37	21	19
5	88	79	70	70	76	81	85	74	67		22.8	5.6	65	44	38	35		
7	63	65	60	68	66	56	76	65	63	18	21.3		69	42	40	37	21	19
5	89	79	66	70	76	81	86	80	67		22.8	5.6	65	44	38	35		
[illegible]	63	66	63	69	67	58	77	66	64	18	24.0		78	48	46	42	24	21
3	90	79	72	71	76	82	87	76	67		22.8	5.7	65	43	38	35		
[illegible]	60	64	56	66	64	54	72	62	61	19	23.1		79	48	47	42	25	22
[illegible]	90	81	73	71	78	82	88	76	68		22.8	5.7	65	43	38	35		
[illegible]	58	62	54	64	62	53	70	61	59	18	22.8		80	48	47	42	25	22
[illegible]	90	80	73	70	77	82	88	76	68		22.8	5.7	65	43	38	35		
	58	61	52	63	61	52	69	60	59	18	20.7		71	42	41	37	22	20
	89	79	73	71	77	82	88	76	68		22.8	5.7	65	43	38	35		
	58	62	52	63	62	52	70	60	59	18	20.4		71	42	41	37	22	20
	90	80	73	72	77	82	88	76	68		22.8	5.7	65	43	38	35		
	59	62	52	63	61	53	70	61	60	18	20.4		71	42	40	37	22	20
	90	82	74	71	79	83	89	76	69		22.8	5.7	65	43	38	35		

D

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
12/8/72	18:20	126:56	2700	250	DUMMY	96	108	85	113	87	109	95	102	104	12
					TEST	98	76	116	118	112	114	100	107	106	11
								Stop - Inspect Strainers On Power							
12/8	19:20	127:26	1100	250	DUMMY	99	110	91	112	89	108	94	102	105	12
					TEST	93	72	108	112	102	103	90	98	94	10
12/8	19:50	127:56	1100	250	DUMMY	97	110	89	113	87	108	93	101	104	12
					TEST	94	74	111	114	106	107	103	101	98	10
12/8	20:20	128:26	1100	250	DUMMY	97	110	89	113	87	108	93	101	104	12
					TEST	94	74	111	114	106	107	103	101	98	10
12/8	20:50	128:56	1950	250	DUMMY	99	112	89	116	91	112	99	105	109	12
					TEST	98	76	113	117	110	111	98	105	103	11
12/8	21:20	129:26	1950	250	DUMMY	99	113	90	116	91	112	99	106	109	12
					TEST	98	76	114	117	110	112	99	106	104	11
12/8	21:50	129:56	1950	250	DUMMY	98	110	89	113	89	109	95	102	105	12
					TEST	100	78	115	118	112	113	101	107	105	11
12/8	22:20	130:26	1950	250	DUMMY	98	108	88	112	87	107	93	100	103	121
					TEST	98	77	112	116	108	109	97	103	101	108
12/8	22:50	130:56	1950	250	DUMMY	97	107	88	111	87	106	93	100	102	120
					TEST	98	77	112	116	108	109	96	103	101	109
12/8	23:20	131:26	1950	250	DUMMY	97	107	87	110	86	106	93	99	102	120
					TEST	96	76	112	115	107	108	96	103	101	108
12/8	23:50	131:56	1950	250	DUMMY	97	107	87	110	86	105	92	99	102	120
					TEST	96	76	111	115	107	108	96	102	100	108

A

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA;LABORATORY BA

TEMPERATURE (°C)

9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
)4	124	03	96	82	82	87	96	79	77	83	85	82	83	85	89	82	81	63	57	47	47	35	46
)6	112	111	104	75	99	107	104	93	92	94	93	93	93	96	96	101	96	85	75	78	76	69	72
Power at 18:50																							
)5	123	95	98	86	84	86	97	80	79	85	80	82	76	82	86	81	74	67	60	62	51	38	50
)4	103	102	94	66	90	94	95	84	83	81	74	74	75	76	78	87	78	74	66	68	68	62	63
4	121	93	96	82	81	85	96	80	78	81	76	79	73	79	82	78	70	67	60	60	49	37	49
8	105	103	96	69	91	95	98	88	87	85	79	99	80	80	82	88	81	78	70	72	71	66	68
4	121	93	96	82	81	85	96	80	78	81	76	79	73	79	82	78	70	67	60	60	49	37	49
8	106	105	97	70	93	97	98	88	87	85	79	79	80	81	83	91	82	79	70	72	71	66	68
9	127	97	100	87	85	90	100	84	82	87	84	85	80	86	89	85	79	70	62	63	52	39	51
3	110	109	101	74	97	102	102	92	90	90	86	86	86	89	89	96	90	82	73	77	75	68	71
)	127	97	100	87	85	91	100	85	83	87	84	85	80	86	90	85	79	70	63	64	53	39	51
	111	110	102	75	97	103	103	92	91	91	87	87	87	90	90	96	91	83	74	78	76	68	76
	123	94	97	85	84	87	97	80	89	85	80	82	76	83	86	81	75	66	60	61	51	40	51
	113	112	104	76	99	104	104	94	92	92	88	88	89	92	92	96	91	85	76	79	77	71	74
	121	91	95	82	82	85	95	78	77	81	77	78	79	80	84	79	73	64	59	59	50	40	50
	108	107	100	72	95	101	101	90	89	88	84	84	85	88	88	93	87	79	71	74	72	67	69
	120	92	94	81	81	84	94	77	76	80	76	78	73	79	82	78	72	64	59	60	50	40	50
	109	108	100	72	95	101	101	90	88	88	84	84	84	87	87	93	87	80	71	74	72	68	69
	120	91	94	81	81	84	94	77	76	80	76	79	73	79	82	78	73	64	59	59	50	40	50
	108	107	99	71	95	100	100	89	88	87	83	83	84	87	87	93	87	79	69	74	74	68	68
	120	91	94	81	80	83	94	77	76	79	75	79	73	78	82	78	72	64	58	59	50	39	49
	108	107	99	71	94	100	100	89	87	87	83	83	83	86	86	93	87	79	69	73	74	68	68

EST (SHEET 27)

38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
84	59	62	52	64	62	53	70	61	60	19	20.4		70	41	40	36	22	20
101	91	82	74	72	78	84	89	77	68		22.8	5.7	65	43	38	35		
84	62	66	54	68	66	56	73	65	63	20	22.8		80	48	46	42	25	22
88	82	76	63	66	73	74	80	69	63		22.2	5.4	65	44	38	36		
82	60	63	56	65	64	55	72	63	61	20	21.0		70	42	40	36	22	20
92	85	79	69	69	76	77	82	71	66		22.8	5.6	65	44	38	36		
82	60	63	56	65	64	55	72	63	61	20	21.0		70	42	40	36	22	20
92	85	79	69	69	76	79	84	72	66		22.8	5.6	65	44	38	36		
87	63	66	60	68	67	57	75	65	64	22	21.3		69	41	39	36	21	19
96	90	81	73	92	79	82	88	76	68		22.8	5.7	65	43	38	36		
87	64	67	61	69	67	58	76	66	64	22	21.3		69	41	39	36	21	19
96	90	82	74	73	79	82	88	77	69		22.8	5.7	65	43	38	36		
84	62	66	54	68	66	57	72	64	62	25	21.0		70	42	40	37	21	19
99	91	82	74	74	79	84	89	77	71		22.8	5.7	64	43	38	35		
82	60	63	53	65	64	55	70	63	61	24	21.0		72	42	40	37	22	19
94	88	82	69	74	79	79	85	74	68		22.5	5.6	65	43	38	35		
82	60	63	54	66	65	55	70	63	62	25	22.8		80	48	46	42	25	21
94	87	81	69	72	78	79	85	74	68		22.5	5.6	65	43	38	36		
81	60	64	54	66	63	55	70	62	62	25	22.8		80	48	46	42	25	21
94	87	79	68	71	77	79	85	76	71		22.5	5.6	65	43	38	36		
81	60	63	53	65	63	55	70	62	62	25	22.5		80	48	46	42	25	21
93	87	79	68	71	77	79	85	77	71		22.5	5.6	65	43	38	36		

C

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
12/9/73	24:20	132:26	1950	250	DUMMY TEST	98 94	108 75	87 111	112 114	87 106	107 107	93 95	100 101	103 99	1 1
12/9	0:50	132:56	1950	250	DUMMY TEST	98 96	108 76	88 110	111 114	86 106	106 107	93 94	100 101	103 99	1 1
12/9	01:20	133:26	1950	250	DUMMY TEST	98 96	108 76	88 110	111 114	86 106	106 107	93 94	100 101	103 99	1 1
12/9	01:50	133:56	2400	250	DUMMY TEST	98 96	108 77	87 112	113 115	88 108	108 109	94 96	101 103	104 101	1 1
						Stop - End of Shift									
12/9	05:40	133:56	2400	250	DUMMY TEST	98 97	110 78	88 114	112 116	88 109	109 108	94 97	101 105	104 102	12 10
12/9	06:10	134:26	2400	250	DUMMY TEST	108 97	120 78	98 112	124 116	101 108	122 108	109 96	116 103	118 101	13 10
12/9	06:40	134:56	2400	250	DUMMY TEST	97 98	106 79	88 112	110 116	87 108	106 109	93 96	99 102	102 100	12 10
12/9	07:10	135:26	2400	250	DUMMY TEST	97 98	106 79	88 112	110 116	86 108	105 109	92 97	99 103	102 102	12 10
12/9	07:40	135:56	2400	250	DUMMY TEST	97 99	106 79	88 113	110 117	86 110	106 110	92 98	99 105	102 102	12 10
12/9	08:10	136:26	2700	250	DUMMY TEST	97 99	107 80	88 115	111 118	88 111	107 112	93 100	100 105	102 104	12 11
12/9	08:40	136:56	2700	250	DUMMY TEST	97 100	107 80	88 115	111 118	88 111	107 113	93 100	100 106	103 105	12 11
						Stop - Inspect Strainers									

A

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABOR

TEMPERATURE (°C)

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
107	93	100	103	121	91	95	82	81	84	95	77	76	80	76	79	73	79	82	78	72	64	59	59
107	95	101	99	107	106	98	70	93	98	98	88	87	86	82	82	82	86	86	93	87	79	69	74
106	93	100	103	120	91	95	81	81	84	95	77	76	79	76	78	74	79	82	78	72	63	59	59
107	94	101	99	107	106	98	70	93	98	98	88	86	85	81	81	82	85	85	93	85	79	71	73
106	93	100	103	121	91	95	81	81	84	95	77	76	79	76	78	74	79	82	78	72	63	59	59
107	94	101	99	107	106	98	70	93	98	98	88	86	85	81	81	82	85	85	93	85	79	69	73
108	94	101	104	123	92	96	82	82	86	96	78	77	81	80	80	78	82	85	80	77	64	59	59
109	96	103	101	108	107	100	71	95	101	100	89	87	87	85	85	86	88	89	95	90	80	69	74
Shift																							
109	94	101	104	128	92	96	78	82	87	96	81	78	76	76	79	74	78	82	81	75	69	63	64
108	97	105	102	108	108	100	73	95	101	101	89	86	86	84	83	85	86	87	91	84	78	71	74
122	109	116	118	138	109	111	96	93	100	110	94	93	97	96	96	94	98	102	97	93	77	72	73
108	96	103	101	108	107	99	71	95	101	100	89	87	88	86	87	87	89	90	95	90	79	71	73
106	93	99	102	122	92	95	82	81	83	94	77	76	81	79	80	76	80	83	80	76	63	59	59
109	96	102	100	108	107	99	70	95	101	100	89	87	87	85	86	86	87	89	94	89	78	70	72
105	92	99	102	121	91	94	81	81	83	94	76	75	80	78	79	74	79	83	79	75	63	58	58
109	97	103	102	109	108	100	71	95	102	101	89	88	88	86	86	86	89	90	95	89	79	76	79
106	92	99	102	121	91	94	81	81	83	93	76	75	80	78	80	74	78	83	79	75	63	57	58
110	98	105	102	109	109	101	72	96	102	101	90	89	89	87	87	87	90	90	96	90	80	71	74
107	93	100	102	123	92	95	82	82	85	95	78	76	81	81	81	78	80	86	81	79	63	53	54
112	100	105	104	110	110	102	73	97	104	103	91	90	91	90	90	91	93	94	98	93	81	73	76
107	93	100	103	123	92	95	82	82	85	96	78	76	82	81	82	78	80	86	81	79	63	53	54
113	100	106	105	111	110	103	73	97	105	103	91	90	90	90	91	91	93	94	98	93	81	73	76
ainers																							

K TEST (SHEET 28)

6	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
0	65	81	60	64	52	66	63	55	70	62	61	25	20.7		71	42	41	38	22	20
8	91	93	87	79	68	71	77	78	85	77	71		22.5	5.6	65	44	38	36		
0	65	81	60	63	51	65	63	55	69	62	61	25	20.7		70	42	40	36	22	20
8	91	93	87	80	68	72	78	79	85	74	68		22.5	5.6	65	44	38	36		
0	65	81	60	63	51	65	63	55	69	62	61	25	20.7		70	42	40	36	22	20
8	91	93	87	80	68	72	78	79	85	74	68		22.5	5.6	65	44	38	36		
1	65	83	61	64	53	65	63	55	70	62	61	25	20.4		70	42	40	36	22	19
9	91	95	87	79	70	71	77	79	85	77	71		22.8	5.6	65	44	38	36		
4	65	84	64	66	63	67	66	58	75	66	65	29	24.0		76	46	44	41	23	20
1	81	93	84	73	70	68	70	77	82	71	64		23.1	5.7	65	43	38	35		
3	73	97	73	76	62	78	76	66	80	75	73	29	23.1		77	47	45	41	24	20
5	90	95	85	80	67	73	77	78	84	75	68		22.8	5.5	65	44	38	35		
	66	83	61	64	53	66	63	56	70	62	62	27	22.5		80	48	46	42	25	21
	89	94	84	79	67	71	76	77	83	74	67		22.8	5.5	65	44	38	35		
	66	82	60	63	52	65	63	55	69	62	60	27	22.5		80	48	47	42	25	21
	90	94	85	80	68	70	77	78	84	74	68		22.8	5.6	65	44	38	35		
	65	82	60	63	52	65	63	55	69	62	60	27	22.5		80	48	47	42	25	22
	90	95	87	80	69	71	77	79	84	76			22.8	5.6	65	44	38	35		
	66	83	60	64	53	65	63	55	69	62	61	27	22.8		80	49	47	42	25	22
	90	98	88	81	70	72	79	80	86	76	68		22.8	5.6	65	44	38	35		
	66	83	60	64	53	65	63	55	69	62	61	27	22.8		80	49	47	42	25	22
	91	98	89	82	71	73	79	80	86	77	69		22.8	5.6	65	44	38	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
12/9/72	09:40	136:56	1100	250	DUMMY TEST	98 95	107 73	89 110	109 113	85 103	103 103	89 91	97 98	100 95	11 10
12/9	10:10	137:26	1100	250	DUMMY TEST	99 97	107 75	91 112	110 115	88 107	106 107	92 96	100 102	102 99	12 10
12/9	10:40	137:56	1100	250	DUMMY TEST	98 98	106 75	90 112	109 116	85 107	103 108	89 102	97 102	100 100	11 10
12/9	11:10	138:26	1100	250	DUMMY TEST	98 97	106 75	90 112	108 115	84 107	103 109	89 105	96 102	99 100	11 10
12/9	11:40	138:56	1950	250	DUMMY TEST	97 100	107 77	89 115	111 118	87 111	106 112	92 100	99 105	102 103	12 11
12/9	12:10	139:26	1950	250	DUMMY TEST	98 100	108 77	89 115	111 119	88 112	106 113	93 102	100 105	102 104	12 11
12/9	12:40	139:56	1950	250	DUMMY TEST	97 100	108 77	89 115	111 119	88 112	106 113	93 100	100 106	102 105	12 11
12/9	13:10	140:26	1950	250	DUMMY TEST	97 100	108 78	89 115	111 119	88 112	106 114	93 100	100 106	102 105	12 11
12/9	13:40	140:56	1950	250	DUMMY TEST	98 100	108 78	89 115	111 119	88 112	106 114	93 100	100 107	102 105	12 11
12/9	14:10	141:26	1950	250	DUMMY TEST	98 101	108 78	89 115	111 119	88 112	106 114	93 100	100 107	102 105	12 11
12/9	14:40	141:56	1950	250	DUMMY TEST	98 100	108 78	89 115	111 119	88 112	106 114	93 100	100 107	102 105	12 11

TABLE XXI. ROLLER GEAR TRANSMISSION TEST

TEMPERA

	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
)	85	103	89	97	100	117	89	92	78	79	81	92	78	75	75	70	75	68	73	77	72
;	103	103	91	98	95	103	103	95	67	90	93	95	85	82	82	73	73	75	76	77	84
)	88	106	92	100	102	120	92	95	82	82	83	93	79	78	82	75	79	73	79	83	78
;	107	107	96	102	99	107	107	99	72	93	99	99	89	87	87	80	80	81	82	83	91
)	85	103	89	97	100	117	89	92	80	80	81	02	87	83	88	82	87	70	74	80	74
5	107	108	102	102	100	108	107	99	72	94	99	100	90	89	89	80	80	81	83	84	92
3	84	103	89	96	99	117	88	91	79	79	80	91	75	73	77	71	75	69	73	78	73
5	107	109	105	102	100	108	107	99	72	95	99	100	90	89	87	80	80	81	82	83	92
1	87	106	92	99	102	121	91	94	81	81	84	93	78	76	81	77	78	76	77	83	79
8	111	112	100	105	103	111	110	102	74	98	103	103	92	**91**	**91**	86	86	87	90	91	95
1	88	106	93	100	102	122	91	94	81	82	84	94	78	77	82	78	79	77	78	83	79
9	112	113	102	105	104	112	111	103	75	98	104	103	93	92	92	87	87	88	91	89	96
1	88	106	93	100	102	122	92	95	82	82	84	94	78	77	82	78	80	76	78	84	79
9	112	113	100	106	105	112	111	103	75	98	104	103	93	92	92	87	87	88	91	91	96
1	88	106	93	100	102	122	92	95	81	82	84	94	78	77	82	78	78	76	78	84	79
9	112	114	100	106	105	112	112	103	75	99	104	103	93	92	92	87	87	89	91	91	96
.1	88	106	93	100	102	122	92	95	82	82	83	94	78	77	82	78	79	76	78	83	79
.9	112	114	100	107	105	112	111	104	75	99	105	104	93	92	92	87	87	89	92	91	96
.1	88	106	93	100	102	122	92	95	82	82	84	94	78	77	82	78	79	77	78	83	79
.9	112	114	100	107	105	112	112	104	75	99	105	104	93	92	92	87	87	89	92	91	96
.1	88	106	93	100	102	122	92	95	82	82	84	94	78	77	82	78	79	76	78	83	79
.9	112	114	100	107	105	112	112	104	75	99	105	104	93	92	92	87	88	89	92	92	96

ABORATORY BACK-TO-BACK TEST (SHEET 29)

28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	PUM FLOW TOTAL ROLL	
63	64	54	45	55	50	71	61	72	62	76	62	62	52	63	62	56	70	62	63	28	23.7	
68	70	69	65	66	66	79	66	79	73	87	81	70	63	64	66	71	79	69	63		22.5	5.5
61	62	52	42	52	48	72	64	72	68	82	63	57	53	66	66	77	71	65	64	27	22.6	
71	74	72	67	69	71	84	70	89	80	92	85	80	68	70	77	77	84	74	68		22.6	5.6
59	59	51	41	50	46	70	60	72	66	79	60	63	52	65	63	55	69	62	62	27	22.5	
72	76	74	70	70	73	85	71	89	82	93	87	81	70	73	79	79	85	76	70		22.5	5.6
58	58	50	40	50	46	69	60	72	65	79	60	63	50	64	63	54	68	62	61	27	22.5	
71	75	74	69	70	73	85	71	89	81	93	87	81	69	72	73	79	85	76	69		22.5	5.6
60	60	51	41	51	47	70	61	71	66	82	61	64	53	66	64	56	70	62	63	27	22.5	
74	77	76	70	72	75	82	74	90	83	96	90	84	71	75	80	82	88	77	71		22.5	5.6
60	60	51	41	51	47	70	61	71	67	82	61	64	53	66	63	56	70	63	63	27	22.5	
76	78	77	71	73	76	89	74	91	83	98	90	84	72	77	80	82	89	78	72		22.5	5.6
60	60	51	42	50	47	70	61	71	66	82	61	64	53	66	64	56	70	63	63	27	22.5	
76	78	77	71	73	76	89	75	92	83	98	90	84	73	76	80	82	89	78	72		22.5	5.6
60	60	51	42	51	47	70	61	71	66	82	61	64	53	66	64	56	70	63	62	28	22.8	
76	78	77	71	73	76	89	75	92	84	98	90	84	73	76	81	82	89	79	71		22.8	5.7
0	60	51	42	51	47	70	62	71	66	82	61	64	53	66	64	46	70	63	62	28	22.8	
8	79	77	71	74	76	89	76	92	84	98	90	84	73	76	81	83	89	73	72		22.8	5.7
0	60	51	42	51	47	70	62	71	66	82	61	64	53	65	64	56	70	63	62	28	22.8	
8	79	77	71	74	76	89	76	92	84	98	90	84	73	76	80	84	89	79	72		22.8	5.7
0	60	51	42	51	47	70	62	71	66	82	61	65	53	66	64	56	70	63	62	28	22.8	
8	79	77	72	74	76	90	76	92	84	98	90	84	73	76	81	84	90	73	72		22.8	5.7

TEST (SHEET 29)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
62	76	62	62	52	63	62	56	70	62	63	28	23.7		82	50	48	43	25	22
79	87	81	70	63	64	68	71	79	69	63		22.5	5.5	65	44	38	36		
68	82	63	67	53	68	66	57	71	65	64	27	22.8		92	40	48	43	25	22
90	92	85	80	68	70	77	77	84	74	68		22.8	5.6	65	44	38	36		
66	79	60	63	52	65	63	55	69	62	62	27	22.5		82	49	47	43	25	22
92	93	87	81	70	73	79	79	85	76	70		22.5	5.6	65	44	38	35		
65	78	60	63	50	64	63	54	68	62	61	27	22.5		82	49	47	43	25	22
91	93	87	81	69	72	78	79	85	76	69		22.5	5.6	65	44	38	36		
66	82	61	64	53	66	64	56	70	62	63	27	22.5		82	49	47	43	25	22
93	96	90	84	71	75	80	82	88	77	71		22.5	5.6	65	44	38	35		
67	82	61	64	53	66	63	56	70	63	63	27	22.5		82	49	47	43	25	22
93	98	90	84	72	77	80	82	89	78	72		22.5	5.6	65	44	38	35		
66	82	61	64	53	66	64	56	70	63	63	27	22.5		82	49	47	43	25	22
93	98	90	84	73	76	80	82	89	78	72		22.5	5.6	65	44	38	35		
66	82	61	64	53	66	64	56	70	63	62	28	22.8		82	49	47	43	25	22
94	98	90	84	73	76	81	82	89	79	71		22.8	5.7	65	44	38	35		
66	82	61	64	53	66	64	46	70	63	62	28	22.8		82	49	47	43	25	22
94	98	90	84	73	76	81	83	89	79	72		22.8	5.7	65	44	38	35		
66	82	61	64	53	65	64	56	70	63	62	28	22.8		82	49	47	43	25	22
94	98	90	84	73	76	80	84	89	79	72		22.8	5.7	65	44	38	35		
66	82	61	65	53	66	64	56	70	63	62	28	22.8		82	49	47	43	25	22
94	98	90	84	73	76	81	84	90	79	72		22.8	5.7	65	44	38	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9
12/9/72	15:10	142:26	1950	250	DUMMY	98	108	90	111	88	107	93	100	10
					TEST	100	77	115	118	112	113	100	107	10
12/9	15:40	142:56	1950	250	DUMMY	98	107	89	111	87	106	93	100	10
					TEST	100	77	115	118	111	113	100	106	10
12/9	16:10	143:26	1950	250	DUMMY	97	107	88	110	87	106	93	99	10
					TEST	100	76	115	118	111	113	100	106	10
12/9	16:40	143:56	2400	250	DUMMY	98	107	88	111	88	107	94	101	10
					TEST	101	77	116	119	113	114	101	108	10
12/9	17:10	144:26	2400	250	DUMMY	98	107	88	111	88	107	94	101	10
					TEST	101	77	116	119	113	114	101	108	10
12/9	17:40	144:56	2400	250	DUMMY	97	107	88	111	88	107	94	101	10
					TEST	101	77	116	119	113	115	102	108	10
12/9	18:10	145:26	2400	250	DUMMY	97	107	88	111	88	107	94	101	10
					TEST	101	77	117	119	113	115	102	108	10
12/9	18:40	145:56	2400	250	DUMMY	97	107	88	111	88	107	94	101	10
					TEST	100	76	116	119	113	114	101	108	10
12/9	19:10	146:26	2700	250	DUMMY	98	108	88	112	89	108	95	101	10
					TEST	101	77	115	118	112	114	100	106	10
12/9	19:40	146:56	2700	250	DUMMY	98	108	88	112	89	108	95	101	10
					TEST	98	74	111	115	108	108	96	102	10
							Stop - Inspect Strainers							On
12/9	20:50	147:26	1100	250	DUMMY	97	107	89	109	85	105	91	98	10
					TEST	95	72	110	114	104	105	94	100	9

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY BAC

														TEMPERATURE (°C)									
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	3[illegible]
122	92	95	82	82	84	94	78	78	82	78	79	76	78	83	79	73	65	60	60	51	42	51	4[illegible]
112	112	104	76	98	104	104	94	92	92	87	88	88	92	92	96	90	84	73	78	77	71	73	7[illegible]
121	91	95	81	82	84	94	78	78	81	78	79	75	77	83	78	73	64	60	59	51	41	50	4[illegible]
112	111	103	75	99	105	104	93	92	92	87	88	88	91	90	96	91	84	77	79	78	72	74	7[illegible]
121	91	94	81	81	84	94	78	76	81	77	78	75	77	83	78	73	69	59	59	50	40	49	4[illegible]
112	111	103	75	98	104	104	93	92	92	87	88	88	91	90	96	91	84	76	79	78	71	74	7[illegible]
123	93	96	82	82	85	95	79	77	83	81	80	79	80	84	80	77	65	60	59	50	40	50	4[illegible]
114	113	105	76	100	106	105	94	93	93	91	91	92	94	92	99	93	85	77	79	78	72	74	7[illegible]
123	93	95	82	82	85	95	79	77	83	81	80	79	80	84	80	78	65	59	59	50	40	50	4[illegible]
113	112	105	76	100	107	105	95	93	94	91	91	92	95	92	100	94	85	77	79	78	72	74	7[illegible]
123	93	95	81	82	85	95	79	77	83	81	80	79	80	84	80	78	65	59	59	50	40	50	4[illegible]
114	112	105	76	100	107	105	95	93	94	91	91	92	95	92	100	94	85	77	79	78	72	74	7[illegible]
123	92	96	82	82	85	95	79	77	83	81	80	79	80	84	80	78	65	60	60	50	40	50	4[illegible]
114	113	105	76	100	107	105	94	93	94	91	92	92	95	92	100	94	85	77	79	78	72	74	7[illegible]
123	93	95	81	82	85	95	79	71	83	81	81	79	80	84	80	73	65	59	59	50	39	49	4[illegible]
113	112	105	76	100	107	105	94	93	93	91	91	92	94	92	100	94	85	77	79	78	72	74	7[illegible]
124	94	96	82	82	86	96	80	78	84	84	82	82	83	86	82	81	65	60	60	50	40	49	45
112	111	104	74	99	106	104	93	92	93	92	92	93	95	92	102	96	85	77	77	76	71	71	74
125	94	96	82	82	86	95	80	78	84	84	82	82	83	86	82	81	65	60	60	50	40	50	45
107	106	99	69	94	103	99	89	87	87	86	86	87	90	87	95	91	79	71	72	71	67	68	70
ower @20:20																							
118	90	93	80	80	82	93	76	75	79	73	76	71	76	80	76	69	65	59	59	50	39	49	45
105	104	96	68	92	96	97	85	84	83	76	77	78	79	81	90	80	77	58	71	70	65	67	69

TEST (SHEET 30)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
67	82	61	65	53	66	63	56	70	63	62	28	22.8		81	49	47	43	25	22
94	98	90	83	73	76	81	83	89	79	73		22.8	5.7	65	43	38	35		
66	82	61	64	53	66	64	56	70	63	62	27	22.8		81	49	47	43	25	22
94	99	91	85	74	77	81	84	90	79	73		22.8	5.7	65	43	38	35		
65	82	60	64	53	65	63	55	70	62	61	25	22.8		81	48	47	43	25	22
94	99	91	85	74	76	81	84	90	79	71		22.8	5.7	74	43	39	35		
65	83	60	64	54	65	64	55	70	63	62	26	22.8		81	48	47	43	25	22
94	101	91	85	74	77	82	85	91	79	73		22.8	5.7	64	43	38	35		
66	83	60	64	54	66	64	55	70	62	61	26	22.8		81	48	47	43	25	22
95	101	92	85	76	77	82	85	91	79	72		22.8	5.7	64	43	38	35		
65	83	60	64	54	65	63	55	70	63	61	25	22.8		81	48	47	20	25	22
95	101	92	85	75	77	82	85	91	79	72		22.8	5.7	64	43	38	35		
65	83	60	64	54	65	64	55	71	63	62	25	22.8		81	48	47	43	25	22
95	101	92	85	74	77	82	85	91	79	72		22.8	5.7	64	43	38	35		
65	83	60	64	54	65	63	55	70	62	61	25	22.8		81	48	47	43	25	22
94	101	92	85	75	76	81	85	91	79	72		22.8	5.6	64	43	38	35		
65	84	61	64	54	66	64	56	71	63	62	25	23.1		81	48	47	43	25	22
95	102	91	85	76	77	82	85	89	79	73		22.5	5.5	65	43	38	35		
65	85	60	65	54	66	64	55	71	63	61	25	23.1		81	48	47	43	25	22
92	95	86	81	67	71	77	78	85	76	68		22.5	5.5	65	43	38	35		
65	80	60	63	53	65	63	55	70	62	62	24	22.8		80	48	47	42	25	22
87	91	84	78	66	68	74	75	82	71	66		22.5	5.5	65	44	38	36		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
12/9/72	21:20	147:56	1100	250	DUMMY TEST	98	107	89	109	85	105	91	98	101	119
						94	72	110	113	104	105	96	99	96	105
12/9	21:50	148:26	1100	250	DUMMY TEST	98	107	89	109	85	105	91	98	101	119
						94	72	110	113	104	105	96	99	96	105
12/9	22:20	148:56	1950	250	DUMMY TEST	97	108	89	111	87	107	94	101	104	123
						96	72	111	115	[illegible]	108	99	102	100	107
12/9	22:50	147:26	1950	250	DUMMY TEST	96	108	89	112	88	108	94	101	104	123
						96	72	111	115	107	108	100	102	100	107
12/9	23:20	149:56	1950	250	DUMMY TEST	97	108	88	112	88	108	94	101	104	123
						96	73	111	115	107	109	100	102	100	107
12/9	23:50	150:26	1950	250	DUMMY TEST	97	108	89	112	88	108	94	101	104	123
						97	73	112	115	107	109	102	102	100	108
12/10	0:20	150:56	1950	250	DUMMY TEST	97	109	89	112	88	108	94	101	104	123
						96	73	112	115	107	108	100	102	100	108
12/10	0:50	151:26	1950	250	DUMMY TEST	97	109	89	112	88	108	94	101	104	123
						96	72	111	115	107	108	102	102	100	108
12/10	1:20	151:56	1950	250	DUMMY TEST	97	109	89	112	88	108	94	101	104	123
						96	72	111	115	107	108	102	102	100	108
12/10	1:50	152:26	1950	250	DUMMY TEST	97	109	89	112	88	108	94	101	104	123
						96	72	111	115	107	108	102	102	100	108
						Stop - End of Shift									
12/10	7:25	152:26	1950	250	DUMMY TEST	92	102	83	106	81	101	88	93	97	115
						90	68	105	110	99	97	96	93	91	99

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABO

TEMPERATURE (°C)

	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	2
5	105	91	98	101	119	90	93	80	80	82	93	76	75	79	73	76	71	76	80	76	69	64	59	5
4	105	96	99	96	105	104	96	68	92	96	97	85	84	83	76	77	78	79	81	90	80	78	68	7
5	105	91	98	101	119	90	93	80	80	82	93	76	75	79	73	76	71	76	80	76	69	64	59	5
4	105	96	99	96	105	104	96	68	92	96	97	85	84	83	76	77	78	79	81	90	80	78	68	7
7	107	94	101	104	123	93	95	82	81	85	95	79	78	82	78	80	76	79	84	79	74	66	60	5
7	108	99	102	100	107	106	98	69	94	100	99	87	85	85	81	81	82	86	85	93	85	79	69	7
8	108	94	101	104	123	93	96	82	82	85	95	80	78	83	79	80	77	79	85	80	75	66	60	6
7	108	100	102	100	107	106	99	70	94	100	99	87	86	86	81	81	83	86	85	94	85	79	70	7
8	108	94	101	104	123	93	96	83	82	85	96	80	78	83	79	80	77	79	84	80	75	66	60	6
7	109	100	102	100	107	106	99	70	94	101	100	88	86	86	82	82	83	86	86	94	85	79	70	7
8	108	94	101	104	123	94	96	83	82	85	96	80	78	83	79	80	77	79	85	80	75	66	60	6
7	109	102	102	100	108	107	99	70	94	101	100	88	86	86	82	82	83	86	86	94	85	79	70	
8	108	94	101	104	123	94	96	83	82	85	96	80	78	83	79	80	77	79	84	80	75	66	60	6
7	108	100	102	100	108	107	99	70	94	101	100	88	86	86	81	81	83	86	86	94	85	79	70	7
8	108	94	101	104	123	94	96	83	82	86	96	80	78	83	79	80	77	80	85	80	75	66	60	
7	108	102	102	100	108	107	99	70	94	101	100	88	86	86	82	82	83	86	86	94	85	79	70	
8	108	94	101	104	123	94	96	83	82	86	96	80	78	83	79	80	77	80	85	80	75	66	60	
7	108	102	102	100	108	107	99	70	94	101	100	88	86	86	82	82	83	86	86	94	85	79	70	
8	108	94	101	104	123	94	96	83	82	86	96	80	78	83	79	80	77	80	85	80	75	66	60	
7	108	102	102	100	108	[illegible]	99	70	94	101	100	88	86	86	82	82	83	86	86	94	85	79	70	
of Shift																								
1	101	88	93	97	115	85	89	73	75	79	88	75	72	71	68	72	65	70	73	69	62	61	58	
9	97	96	93	91	99	98	89	60	86	94	90	79	76	76	69	69	70	82	73	74	69	66	59	

A:LABORATORY BACK-TO-BACK TEST (SHEET 31)

(°C)																							FL
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL
	64	59	59	49	39	49	45	70	60	70	65	80	60	63	53	64	63	55	70	62	62	24	22.8
	78	68	71	70	65	67	69	82	68	85	88	91	84	79	66	68	76	76	82	72	66		22.5
	64	59	59	49	39	49	45	70	60	70	65	80	60	63	53	64	63	55	70	62	62	24	22.5
	78	68	71	70	65	67	69	82	68	85	88	91	84	70	66	68	76	76	82	72	66		22.5
	66	60	59	50	39	49	45	71	60	71	65	83	61	64	55	65	64	55	71	63	63	24	22.8
	79	69	72	71	66	68	70	83	69	85	88	93	85	79	68	69	77	78	83	72	66		22.8
	66	60	60	50	39	50	45	72	62	72	65	83	61	64	55	66	64	55	71	63	63	24	23.1
	79	70	73	71	66	68	71	84	70	85	89	94	85	79	68	70	77	78	84	74	66		22.8
	66	60	60	50	39	49	45	72	62	72	65	83	61	64	55	65	64	55	72	63	63	24	23.1
	79	70	72	71	66	68	71	84	70	85	89	94	85	80	68	70	77	78	84	74	67		22.
	66	60	60	50	39	49	45	72	62	72	65	83	61	64	55	65	64	55	72	64	62	24	22.
	79	70	72	71	66	68	71	84	70	85	89	94	85	80	68	70	77	78	84	74	66		22.
	66	60	60	51	39	49	45	72	62	72	65	83	61	64	55	65	64	55	71	64	61	24	22.
	79	70	72	71	66	68	71	84	70	86	90	94	86	79	68	71	77	79	84	74	66		22.
5	66	60	60	50	39	49	45	72	62	72	65	83	61	64	55	66	64	55	72	64	62	24	22.
5	79	70	72	71	66	68	71	84	70	86	90	94	85	80	68	70	77	78	84	74	67		22.
5	66	60	60	50	39	49	45	72	62	72	65	83	61	64	55	66	64	55	72	64	62	24	22.
5	79	70	72	71	66	68	71	84	70	86	90	94	85	80	68	70	77	78	84	74	67		22
5	66	60	60	50	39	49	45	72	62	72	65	83	61	64	55	66	64	55	72	64	62	24	22
5	79	70	72	71	66	68	71	84	70	86	90	94	85	80	68	70	77	78	84	74	67		22
2	61	58	59	50	40	50	45	67	58	68	62	73	59	60	50	63	60	53	67	61	60	25	21
9	66	59	62	61	57	64	60	71	59	71	74	82	73	65	57	59	62	66	72	62	58		22

(SHEET 31)

											PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
											FLOW							
8	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
0	60	63	53	64	63	55	70	62	62	24	22.8		80	48	47	42	25	22
1	84	79	66	68	76	76	82	72	66		22.5	5.5	65	44	38	36		
0	60	63	53	64	63	55	70	62	62	24	22.5		80	43	47	42	25	22
1	84	70	66	68	76	76	82	72	66		22.5	5.5	65	44	38	36		
3	61	64	55	65	64	55	71	63	63	24	22.8		80	48	47	42	25	22
3	85	79	68	69	77	78	83	72	66		22.8	5.6	65	43	38	35		
3	61	64	55	66	64	55	71	63	63	24	23.1		80	48	47	42	25	22
4	85	79	68	70	77	78	84	74	66		22.8	5.6	65	43	38	35		
3	61	64	55	65	64	55	72	63	63	24	23.1		80	48	47	42	25	22
4	85	80	68	70	77	78	84	74	67		22.8	5.6	65	43	38	35		
3	61	64	55	65	64	55	72	64	62	24	22.8		80	48	47	42	25	22
4	85	80	68	70	77	78	84	74	66		22.8	5.6	65	43	38	35		
3	61	64	55	65	64	55	71	64	61	24	22.8		80	48	47	42	25	22
4	86	79	68	71	77	79	84	74	66		22.8	5.6	65	43	38	35		
3	61	64	55	66	64	55	72	64	62	24	22.8		80	48	47	42	25	22
4	85	80	68	70	77	78	84	74	67		22.8	5.6	65	43	38	35		
13	61	64	55	66	64	55	72	64	62	24	22.8		80	48	47	42	25	22
14	85	80	68	70	77	78	84	74	67		22.8	5.6	65	43	38	35		
3	61	64	55	66	64	55	72	64	62	24	22.8		80	48	47	42	25	22
4	85	80	68	70	77	78	84	74	67		22.8	5.6	65	43	38	35		
3	59	60	50	63	60	53	67	61	60	25	21.0		74	44	42	39	23	20
2	73	65	57	59	62	66	72	62	58		22.2	5.3	65	44	38	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	
12/10/72	07:55	152:56	1950	250	DUMMY TEST	96 94	107 72	86 110	111 114	86 105	107 105	93 103	100 100	1
12/10	08:25	153:26	1950	250	DUMMY TEST	96 96	108 72	87 111	112 115	87 106	107 106	93 104	101 100	1
12/10	08:55	153:56	2400	250	DUMMY TEST	96 96	109 73	88 112	113 115	88 107	109 108	95 105	102 102	1 1
12/10	09:25	154:26	2400	250	DUMMY TEST	96 96	109 73	88 112	113 115	89 107	110 110	95 106	102 103	1 1
12/10	09:55	154:56	2400	250	DUMMY TEST	97 96	110 73	88 112	113 116	89 108	110 110	95 106	103 103	1 1
12/10	10:25	155:26	2400	250	DUMMY TEST	96 96	109 73	88 112	113 116	89 108	110 110	96 105	102 103	1 1
12/10	10:55	155:56	2400	250	DUMMY TEST	96 96	110 73	88 112	113 116	89 109	110 109	96 106	103 103	1 1
12/10	11:25	156:26	2700	250	DUMMY TEST	96 98	110 74	89 113	115 116	91 109	112 109	97 107	105 104	10 10
12/10	11:55	156:56	2700	250	DUMMY TEST	97 98	110 75	89 113	114 116	90 109	111 109	97 107	105 104	10 10
							Stop - Inspect Strainers						Change	
12/10	13:00	156:56	3000	425	DUMMY TEST	90 94	100 74	81 110	104 114	79 105	98 104	85 101	92 100	9 9
12/10	13:30	157:26	3000	425	DUMMY TEST	92 97	103 75	83 114	107 117	82 110	102 110	89 110	95 105	9 10

TABLE XXI. ROLLER GEAR TRAN

TAIL H.P.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
250	DUMMY	96	107	86	111	86	107	93	100	102	122	92	95	80	80	85	93	78	77	81	78	
	TEST	94	72	110	114	105	105	103	100	98	105	104	96	67	92	99	97	85	84	84	79	
250	DUMMY	96	108	87	112	87	107	93	101	104	123	92	95	82	81	85	95	79	78	82	79	
	TEST	96	72	111	115	106	106	104	100	99	106	105	97	69	92	100	98	87	85	85	80	
250	DUMMY	96	109	88	113	88	109	95	102	105	125	93	97	83	82	87	97	80	79	84	83	
	TEST	96	73	112	115	107	108	105	102	100	107	106	98	70	93	101	100	88	86	86	83	
50	DUMMY	96	109	88	113	89	110	95	102	105	124	94	97	83	83	88	97	89	79	84	83	[illegible]
	TEST	96	73	112	115	107	110	106	103	101	108	107	99	70	94	102	100	88	87	87	84	[illegible]
50	DUMMY	97	110	88	113	89	110	95	103	105	125	94	97	83	83	87	97	81	79	85	83	8
	TEST	96	73	112	116	108	110	106	103	101	108	107	99	70	94	102	100	88	87	87	84	8
0	DUMMY	96	109	88	113	89	110	96	102	105	125	94	97	83	83	88	97	81	79	85	83	8
	TEST	96	73	112	116	108	110	105	103	101	108	107	99	70	94	102	100	88	87	87	84	8
0	DUMMY	96	110	88	113	89	110	96	103	106	126	95	98	84	83	88	97	81	80	85	83	82
	TEST	96	73	112	116	109	109	106	103	101	109	107	100	70	94	102	100	89	88	87	85	85
	DUMMY	96	110	89	115	91	112	97	105	107	127	96	99	85	85	89	98	82	80	88	87	85
	TEST	98	74	113	116	109	109	107	104	102	110	109	100	71	96	103	100	90	89	89	87	88
	DUMMY	97	110	89	114	90	111	97	105	107	126	96	98	85	85	89	98	81	80	87	87	85
	TEST	98	75	113	116	109	109	107	104	102	110	109	100	71	96	104	101	90	89	89	87	86
		Stop - Inspect Strainers						Change tail Load to 425 HP														
	DUMMY	90	100	81	104	79	98	85	92	95	113	81	87	75	74	78	87	70	69	72	70	70
	TEST	94	74	110	114	105	104	101	100	99	105	104	97	68	92	101	98	86	85	86	81	81
	DUMMY	92	103	83	107	82	102	89	95	98	118	85	90	78	77	81	90	73	72	78	78	76
	TEST	97	75	114	117	110	110	110	105	103	110	111	102	73	97	105	102	92	92	93	89	89

N TEST DATA:LABORATORY BACK-TO-BACK TEST (SHEET 32)

TEMPERATURE (°C)

	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	83	80	74	65	60	60	50	39	49	45	72	61	71	64	82	61	63	53	65	63	54	71	62	62
	83	91	82	75	66	69	68	62	65	66	80	67	83	87	90	81	76	65	67	72	74	80	70	64
	85	81	75	65	60	60	50	39	49	45	72	61	72	64	83	61	63	[illegible]	65	63	55	71	63	62
	85	93	83	77	67	70	69	63	66	68	82	68	84	89	92	83	78	66	69	74	76	82	71	65
	88	82	79	66	60	61	51	39	50	45	72	62	72	65	85	61	64	55	66	64	56	72	63	[illegible]
	89	94	87	78	68	71	70	63	67	69	82	69	85	89	94	84	79	67	69	76	77	83	72	66
	87	83	79	66	60	60	50	38	50	45	72	62	72	65	85	[illegible]	64	55	66	63	55	72	63	[illegible]
	89	94	87	78	69	71	70	65	67	69	83	69	85	89	94	84	79	67	69	76	77	83	72	[illegible]
	87	83	79	66	60	61	50	39	50	45	72	62	72	65	85	61	64	55	66	64	56	72	64	[illegible]
	89	94	87	78	69	71	70	65	67	69	83	74	85	89	94	85	79	68	69	76	77	83	72	[illegible]
	87	83	80	66	61	61	50	39	50	46	72	62	72	65	85	61	64	55	66	64	56	72	63	6
	89	94	88	78	69	71	70	65	68	69	83	69	86	89	94	85	79	67	69	69	77	83	73	6
	87	83	80	66	61	61	51	40	50	46	72	62	72	65	85	61	65	55	66	64	56	72	63	6
	90	94	88	79	69	71	70	66	67	69	83	69	86	89	94	85	80	68	69	76	77	84	72	6
3	90	86	83	67	61	62	51	40	51	46	73	63	73	65	87	62	66	56	65	64	56	72	64	6
2	92	96	91	79	69	72	71	66	68	70	84	70	87	72	96	87	80	68	70	77	79	84	74	6
8	90	85	82	67	62	62	51	40	51	46	73	63	73	65	87	62	65	56	66	64	56	73	64	6
2	92	96	91	80	70	73	71	66	69	70	85	71	87	90	96	87	80	69	71	76	79	85	74	6
1	74	71	67	58	58	57	48	39	49	45	66	55	67	62	75	56	59	42	61	58	50	65	58	[illegible]
5	85	89	80	74	69	74	71	67	68	69	79	65	80	81	90	81	70	63	64	68	72	91	68	[illegible]
8	80	76	75	60	60	59	50	39	50	46	68	57	69	63	79	58	61	43	61	59	51	67	60	[illegible]
3	91	99	93	82	77	80	79	73	74	78	88	72	91	91	98	90	83	70	73	80	81	88	78	[illegible]

0

(SHEET 32)

	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
2	61	63	53	65	63	54	71	62	62	23	21.5		74	44	42	38	22	19
0	81	76	65	67	72	74	80	70	64		22.5	5.5	65	44	38	35		
3	61	63	54	65	63	55	71	63	62	23	21.0		73	44	42	38	22	19
2	83	78	66	69	74	76	82	71	65		22.5	5.5	65	44	38	35		
5	61	64	55	66	64	56	72	63	63	23	21.0		72	44	42	38	22	19
4	84	79	67	69	76	77	83	72	66		22.5	5.5	65	44	38	35		
5	62	64	55	66	63	55	72	63	63	23	21.3		72	44	42	38	22	19
4	84	79	67	69	76	77	83	72	66		22.5	5.5	65	44	38	35		
5	61	64	55	66	64	56	72	64	63	23	21.6		72	44	42	38	22	19
4	85	79	68	69	76	77	83	72	66		22.8	5.6	65	44	38	35		
5	61	64	55	66	64	56	72	63	62	23	21.3		73	44	42	38	22	19
4	85	79	67	69	69	77	83	73	66		22.5	5.6	65	44	38	35		
5	61	65	55	66	64	56	72	63	63	23	21.3		73	44	42	38	22	19
4	85	80	68	69	76	77	84	72	66		22.5	5.6	65	44	38	38		
7	62	66	56	65	64	56	72	64	64	23	21.6		73	44	42	38	22	19
6	87	80	68	70	77	79	84	74	67		22.5	5.6	65	44	38	35		
7	62	65	56	66	64	56	73	64	63	24	21.6		72	44	42	38	22	19
6	87	80	69	71	76	79	85	74	67		22.8	5.6	65	44	38	35		
5	56	59	42	61	58	50	65	58	59	22	20.1		78	46	44	39	23	20
0	81	70	63	64	68	72	91	68	61		22.5	5.5	66	44	38	36		
9	58	61	43	61	59	51	67	60	60	23	21.4		77	46	44	39	23	20
8	90	83	70	73	80	81	88	78	70		22.8	5.6	66	44	38	36		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	
12/10/72	14:00	157:56	3000	425	DUMMY	92	102	83	108	82	102	89	96	98	1
					TEST	98	76	114	117	110	111	110	106	104	1
12/10	14:30	158:26	3000	425	DUMMY	96	108	88	112	88	109	95	102	105	1
					TEST	98	76	115	117	112	112	110	105	104	1
12/10	15:00	158:56	3000	425	DUMMY	97	109	89	113	89	110	96	103	105	1
					TEST	98	76	115	118	112	112	110	106	104	11
12/10	15:30	159:26	3000	425	DUMMY	97	109	90	113	89	110	96	103	105	12
					TEST	99	76	114	116	110	110	109	106	104	11
12/10	16:00	159:56	3000	425	DUMMY	97	109	90	113	89	110	96	103	105	12
					TEST	99	76	114	116	110	110	109	106	104	11
12/10	16:15	160:11	1950	425	DUMMY	98	109	89	112	88	108	94	101	104	12
					TEST	97	75	112	116	109	109	107	104	102	11
12/10	16:45	160:41	3000	425	DUMMY	97	108	88	112	88	109	95	102	105	12
					TEST	99	76	114	117	111	111	110	106	104	11
12/10	17:15	161:11	3000	425	DUMMY	97	108	88	112	88	109	95	102	105	12
					TEST	99	76	114	117	111	111	110	106	104	11
12/10	17:45	161:41	3000	425	DUMMY	97	109	88	113	89	110	96	103	105	12
					TEST	99	76	114	117	111	111	110	106	104	11
12/10	18:15	162:11	3000	425	DUMMY	97	109	89	113	89	110	96	103	105	12
					TEST	99	76	115	117	111	112	111	107	105	112
12/10	18:45	162:41	3000	425	DUMMY	97	109	89	113	89	110	96	103	105	126
					TEST	99	76	115	117	111	112	111	107	105	112

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY E

	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
															TEMPERATURE (°C)								
5	98	119	86	91	78	78	81	91	73	72	78	79	76	75	79	80	76	75	60	60	59	50	39
5	104	110	110	102	74	97	106	103	92	92	93	90	90	91	93	92	100	93	83	77	81	79	72
2	105	125	93	97	83	82	87	97	81	79	85	85	83	83	86	87	83	81	66	64	64	54	42
5	104	111	110	103	73	97	106	103	93	92	94	90	90	91	95	96	99	93	84	78	81	79	75
3	105	127	95	98	84	83	88	98	81	80	86	86	84	85	87	88	83	81	67	65	65	54	43
5	104	111	110	103	73	97	106	103	93	92	94	90	90	91	95	95	99	93	84	78	81	79	73
3	105	126	95	98	84	84	88	98	81	80	86	86	83	84	87	88	83	81	67	65	65	54	43
5	104	111	110	102	73	97	106	103	92	92	94	89	89	91	94	94	99	94	84	78	82	79	73
3	105	126	95	98	84	84	88	98	81	80	86	86	83	84	87	88	83	81	67	65	65	54	43
5	104	111	110	102	73	97	106	103	92	92	94	89	89	91	94	94	99	94	84	78	82	79	74
1	104	124	92	96	83	83	85	97	80	79	83	79	80	88	83	87							
4	102	110	108	101	72	96	103	101	91	90	91	83	83	84	88	86							
2	105	126	95	97	82	83	87	98	80	79	85	85	83	84	86	87	83	81	67	65	65	55	43
5	104	111	110	104	73	97	107	103	92	92	93	89	89	91	94	91	99	93	84	78	82	79	74
2	105	126	94	97	84	83	87	98	80	79	85	85	84	84	86	89	83	81	67	64	64	54	43
6	104	111	110	102	73	97	107	103	92	92	93	90	90	91	94	94	99	94	85	78	82	79	74
3	105	125	94	98	84	83	88	98	81	80	85	85	84	83	87	88	83	82	67	65	65	54	43
6	104	111	110	102	73	98	107	103	92	92	93	90	90	91	94	94	99	94	85	78	82	79	74
3	105	125	94	98	84	84	88	98	81	80	85	85	84	83	87	89	83	82	67	65	65	55	43
7	105	112	111	103	74	98	107	104	93	92	94	90	90	92	95	95	99	94	85	78	82	80	74
3	105	126	94	98	84	84	88	98	81	80	85	86	84	84	87	89	83	82	67	65	65	54	43
7	105	112	111	103	74	98	107	104	93	92	94	90	90	92	95	93	100	94	85	79	82	80	75

TEST (SHEET 33)

												PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
												FLOW							
37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
64	79	58	61	44	61	59	51	67	60	59	22	21.0		75	45	42	39	23	20
92	98	90	82	70	74	79	81	89	78	70		22.8	5.6	66	44	38	35		
67	85	63	66	53	66	64	56	73	64	65	23	21.6		75	45	43	39	23	20
92	99	91	84	70	74	80	82	89	78	70		22.8	5.6	66	44	38	35		
67	86	63	66	53	67	65	57	73	66	64	24	21.6		75	45	43	39	23	20
92	99	91	85	70	76	80	81	89	78	71		22.8	5.6	65	44	38	35		
67	86	63	66	53	67	65	56	73	65	64	25	21.3		75	44	43	38	23	20
93	99	91	84	71	76	80	82	89	79	71		22.8	5.6	65					
67	86	63	66	53	67	65	56	73	65	64	25	21.3		75	44	43	38	23	20
93	99	91	84	71	76	80	82	89	79	71		22.8	5.7	65	43	38	35		
											25	21.3		74	44	42	38	23	20
												22.8	5.7	65	43	38	35		
67	85	63	67	53	68	66	57	73	65	64	25	21.3		74	44	42	38	23	20
92	99	91	83	71	75	80	82	89	78	71		22.8	5.7	65	43	38	35		
67	86	63	67	53	68	66	57	73	65	64	25	21.3		73	44	42	38	23	20
93	99	91	85	71	76	80	82	89	78	71		22.8	5.7	65	43	38	35		
67	86	63	67	53	68	66	57	73	65	64	25	21.3		73	43	42	38	22	19
93	99	91	85	71	77	80	82	89	78	71		22.8	5.7	65	43	38	35		
67	86	63	67	53	69	67	57	73	65	65	24	21.0		73	43	41	38	22	19
93	100	91	85	71	76	80	82	90	79	71		22.8	5.7	65	43	38	35		
67	86	63	67	53	69	66	57	74	65	66	25	20.7		71	42	40	37	21	19
93	100	91	85	71	77	80	82	90	79	71		22.8	5.7	65	43	38	35		

C

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
12/10/72	19:15	163:11	3000	425	DUMMY	97	109	89	114	89	110	96	103	106	126
					TEST	99	76	115	117	112	112	111	107	105	112
12/10	19:45	163:41	3000	425	DUMMY	98	109	89	114	89	110	96	103	106	126
					TEST	99	76	115	117	111	112	111	107	105	11
12/10	20:00	163:56	1950	425	DUMMY	99	110	90	114	89	110	96	103	106	126
					TEST	100	76	114	118	111	111	108	106	104	111
12/10	20:30	164:26	3560	425	DUMMY	98	110	89	115	90	112	97	105	107	128
					TEST	101	78	116	118	113	113	112	109	107	114
12/10	20:45	164:41	1950	425	DUMMY	100	111	91	115	90	111	97	104	107	127
					TEST	100	77	115	118	111	112	110	107	105	112
12/10	21:15	165:11	3560	425	DUMMY	98	110	89	115	90	112	97	105	107	128
					TEST	101	77	116	118	113	114	112	109	107	114
12/10	21:30	165:26	1950	425	DUMMY	98	110	90	114	89	109	96	103	106	125
					TEST	100	76	115	118	111	112	110	106	104	112
12/10	22:00	165:56	3560	425	DUMMY	98	110	89	114	90	112	97	105	107	127
					TEST	100	77	116	118	113	113	112	108	107	113
						Stop - Check Torquing Device for Travel O									
12/10	22:40	166:11	1950	425	DUMMY	98	109	89	112	87	107	93	100	103	124
					TEST	96	73	110	114	104	104	102	100	97	104
12/10	22:55	166:26	3700	425	DUMMY	96	108	89	113	89	110	96	103	105	128
					TEST	96	74	111	114	112	105	105	102	100	107
12/10	23:10	166:41	1950	425	DUMMY	98	109	91	113	88	109	84	104	105	125
					TEST	97	74	101	115	106	107	105	101	99	107

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA;LABORATORY

TEMPERATURE (°C)

8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
103	106	126	95	98	85	84	88	99	81	80	85	86	84	84	87	90	84	83	67	65	65	54	42
107	105	112	111	103	74	98	107	104	93	92	94	90	90	92	95	94	100	94	85	79	82	80	75
.03	106	126	94	98	84	84	88	99	81	80	85	86	84	85	87	89	83	83	67	65	65	55	43
.07	105	11	111	103	74	98	107	104	93	92	94	90	90	92	95	95	99	94	85	78	82	80	75
.03	106	126	94	98	84	84	87	98	81	80	85	84	84	83	86	90							
.06	104	111	110	102	73	98	105	103	93	92	93	86	87	88	92	90							
.05	107	128	95	100	85	85	90	100	82	81	86	91	89	89	91	92	86	89	67	65	65	54	43
.09	107	114	112	105	76	100	110	106	95	94	97	95	95	96	100	99	104	98	86	79	83	82	75
104	107	127	95	99	85	85	88	100	82	81	87	87	86	86	89	92							
107	105	112	111	103	74	98	106	105	94	93	94	87	88	89	93	91							
105	107	128	96	100	84	85	90	100	81	81	87	92	89	89	92	94	87	89	68	65	65	55	43
109	107	114	113	105	76	100	110	106	95	95	97	95	95	97	100	99	104	99	86	79	83	82	77
103	106	125	94	98	84	84	87	98	81	80	85	82	82	80	85	88							
106	104	112	111	103	74	98	106	104	94	92	93	86	86	87	91	90							
105	107	127	95	99	85	85	90	100	81	80	86	91	89	88	91	94	87	88	67	65	65	54	43
108	107	113	112	105	76	100	110	106	95	94	96	95	95	96	100	99	104	99	85	79	83	82	77
r Travel		On Power		at 22:25																			
100	103	124	92	96	82	82	84	96	79	78	79	73	76	71	76	80							
100	97	104	103	96	66	92	97	97	85	84	85	76	76	77	80	78							
103	105	128	95	99	83	84	88	98	80	79	83	86	85	83	87	91							
102	100	107	106	98	68	94	103	99	87	86	89	84	84	86	90	87							
.04	105	125	95	98	84	84	85	97	80	79	84	80	83	78	83	71							
.01	99	107	106	98	68	93	101	99	88	86	87	79	81	82	85	82							

K TEST (SHEET 34)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
67	86	63	67	53	69	66	57	74	65	65	24	20.7		70	42	40	37	22	19
93	100	91	85	71	75	81	82	90	79	71		22.8	5.7	65	43	38	35		
66	86	63	67	53	69	66	57	73	65	65	24	20.7		70	41	40	36	18	22
93	100	91	85	72	76	81	82	90	79	71		22.8	5.7	65	43	38	35		
												20.4		70	41	40	36	22	19
												22.8	5.7	65	43	38	35		
67	88	64	66	54	68	66	57	74	65	65	24	20.7		70	41	40	35	22	19
93	103	93	86	72	76	82	79	91	80	72		22.8	5.7	65	43	38	35		
												20.4		70	42	40	35	22	19
												22.8	5.7	66	43	38	35		
67	88	64	67	54	69	66	57	74	66	65	25	21.0		70	42	40	35	22	19
93	103	93	85	73	77	82	85	85	80	72		22.8	5.7	65	43	38	35		
												20.7		71	43	40	36	22	19
												22.8	5.7	65	43	38	35		
67	88	63	66	54	68	66	57	74	65	64	24	20.7		70	42	41	36	22	19
93	103	93	85	74	77	82	85	91	79	72		22.8	5.7	65	43	38	35		
												21.0		72	44	42	38	23	20
												22.5	5.4	65	44	38	35		
												22.8		71	43	42	38	22	19
												22.5	5.5	65	44	38	36		
												22.5		78	48	45	42	24	21
												22.5	5.5	65	44	38	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
12/10/72	23:25	166:56	3700	425	DUMMY	97	109	89	116	90	111	97	104	107	129
					TEST	98	75	112	115	108	108	107	103	101	118
						Stop - Remove Test and Dummy for Inspecti									
1/9/73	11:15	166:56	1950	250	DUMMY	56	115	107	121	91	116	110	109	112	113
					TEST	99	73	121	126	117	116	109	113	110	117
1/9	11:45	167:26	1950	250	DUMMY	52	108	103	115	83	107	91	100	103	125
					TEST	95	69	115	119	110	110	107	106	103	111
1/9	12:15	167:56	1950	250	DUMMY	52	108	102	115	83	112	92	99	102	12
					TEST	95	69	115	119	110	111	107	106	103	111
						Stop - Inspect Strainers									
1/9	13:50	167:56	1950	250	DUMMY	54	107	102	113	82	106	90	98	102	12
						92	69	111	116	105	104	99	100	98	10
1/9	14:20	168:26	1950	250	DUMMY	54	108	111	114	82	106	91	98	102	12
					TEST	94	70	113	117	107	108	105	103	100	10
1/9	14:50	168:56	1950	250	DUMMY	54	109	112	116	84	108	93	100	104	13
					TEST	93	71	114	119	109	109	107	105	102	11
						Stop - Inspect Strainers									
1/10	10:10	168:56	1100	250	DUMMY	66	108	109	112	85	103	88	96	100	11
					TEST	94	95	117	120	112	111	106	106	102	11
1/10	10:40	169:26	1100	250	DUMMY	68	108	111	113	85	114	89	96	100	11
					TEST	97	98	121	124	117	117	112	111	108	11
1/10	11:10	169:56	1100	250	DUMMY	72	110	112	115	88	106	91	98	102	12
					TEST	96	97	119	121	114	114	110	109	105	11

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY

	TEMPERATURE (°C)																						
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
4	107	129	90	100	85	84	89	99	81	80	85	89	88	86	88	94							
3	101	118	117	100	70	95	105	101	87	86	90	88	88	90	94	93							
r Inspection																							
9	112	113	101	110	89	86	91	103	89	84	90	83	86	81	85	90	86	79	81	63	69	53	38
3	110	117	116	107	81	102	105	107	95	91	89	85	88	85	95	88	89	89	85	74	76	77	67
0	103	125	91	97	83	81	82	94	76	75	84	75	78	73	77	83	77	69	62	53	57	43	32
6	103	111	111	101	72	96	103	102	91	87	86	81	85	81	92	84	88	88	80	69	71	72	63
9	102	124	90	96	80	79	87	93	76	73	80	73	77	70	75	80	76	66	62	53	57	43	31
6	103	111	110	101	72	96	104	102	90	87	86	82	85	80	91	84	87	88	86	69	70	72	63
8	102	123	89	94	78	79	80	92	76	73	79	70	75	68	72	77	74	65	62	54	58	43	33
0	98	105	103	95	66	91	97	97	84	80	77	72	74	71	84	75	78	78	74	65	66	67	60
8	102	124	89	95	80	79	82	93	77	73	80	71	76	70	74	80	75	66	62	53	57	43	33
3	100	108	107	99	69	93	102	100	87	85	85	79	83	78	91	81	85	86	78	67	69	69	63
0	104	130	92	97	81	80	83	95	79	76	82	74	78	72	76	82	77	68	63	54	58	44	32
5	102	110	109	100	71	94	102	101	89	86	85	80	83	79	91	83	84	85	79	69	70	70	63
6	100	119	87	92	81	84	78	90	73	73	78	67	72	65	70	75	71	62	63	66	65	56	57
6	102	113	102	104	75	101	101	104	94	90	87	79	82	80	91	81	84	85	83	79	79	78	78
6	100	119	87	92	78	83	78	91	74	73	77	65	72	63	69	73	69	60	62	64	63	55	57
1	108	117	105	109	80	105	105	109	100	95	92	85	88	85	96	87	90	91	89	85	85	84	84
8	102	121	89	94	81	86	80	93	76	75	79	68	74	66	71	76	73	62	64	67	66	58	61
9	105	115	105	106	77	103	104	106	96	92	90	82	85	82	94	84	88	89	88	82	82	81	80

8

K TEST (SHEET 35)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
												22.8		77	47	45	41	24	21
												22.5	5.6	65	43	38	35		
72	90	74	75	62	75	73	64	70	72	70	13	21.6		70	42	40	37	21	19
87	92	99	76	77	67	76	79	84	76	66		22.8	5.4	64	43	37	35		
64	82	66	64	46	63	62	53	58	62	58	11	19.2		71	42	40	36	21	18
91	89	96	75	69	66	74	79	85	72	63		22.5	5.4	64	43	37	35		
61	80	65	60	47	59	58	51	56	59	56	11	19.2		70	42	40	36	21	18
91	89	95	75	69	66	74	79	85	72	63		22.5	5.3	64	44	38	35		
65	79	65	64	46	62	61	53	58	62	59	13	19.5		71	42	40	36	21	18
81	81	91	68	63	61	67	71	79	68	60		22.5	5.3	65	44	38	35		
62	80	65	60	47	59	58	51	57	60	57	13	19.5		71	42	40	36	21	18
91	86	93	75	65	67	73	76	83	72	63		22.5	5.3	65	44	38	35		
63	82	66	62	49	61	60	52	58	61	58	11	19.8		70	42	40	36	21	18
90	87	94	74	68	66	72	78	84	72	63		22.5	5.3	65	44	38	35		
79	78	69	72	43	72	69	63	63	69	68	12	18.9		71	42	40	36	21	18
99	93	95	101	69	96	96	81	90	91	93		22.5	5.3	66	44	38	35		
78	77	68	69	44	69	66	61	61	67	67	12	18.9		72	42	40	36	21	18
106	96	101	107	74	103	103	85	94	95	99		25.5	5.4	65	43	37	35		
79	80	70	71	47	71	69	63	63	70	69	12	19.5		71	42	40	36	21	18
106	96	99	106	72	102	102	85	93	94	98		22.8	5.3	65	43	37	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
1/10/73	11:40	170:26	1100	250	DUMMY TEST	72 96	110 97	113 119	115 121	89 114	106 114	91 109	98 108	102 105	122 114
1/10	12:10	170:56	1950	250	DUMMY TEST	74 99	111 99	112 121	116 125	92 117	109 117	93 113	101 112	104 110	125 119
1/10	12:40	171:26	1950	250	DUMMY TEST	75 99	111 100	112 122	116 125	91 118	108 118	93 113	100 112	104 110	126 119
1/10	13:10	171:56	1950	250	DUMMY TEST	76 99	111 101	113 122	117 125	92 119	109 119	94 114	101 112	105 110	126 119
1/10	13:40	172:26	1950	250	DUMMY TEST	65 90	109 93	103 119	115 123	87 119	107 105	92 110	100 110	103 108	124 116
1/10	14:10	172:56	1950	250	DUMMY	66 91	115 93	107 119	121 123	94 119	116 115	100 110	108 110	111 107	131 116
1/10	14:40	173:26	1950	250	DUMMY TEST	62 88	108 91	101 119	114 123	86 119	106 115	92 111	98 110	102 108	123 116
1/10	15:10	173:56	2400	250	DUMMY TEST	61 89	108 92	101 120	115 123	86 120	107 117	92 112	99 111	103 109	125 118
1/10	15:40	174:26	2400	250	DUMMY TEST	61 87	108 90	100 118	115 122	86 118	107 115	93 111	99 110	103 107	125 116
1/10	16:10	174:56	2400	250	DUMMY TEST	60 87	108 90	101 118	115 122	86 118	107 115	92 111	99 110	103 107	125 116
1/10	16:40	175:26	2400	250	DUMMY TEST	60 86	108 90	100 118	114 122	85 118	107 115	92 111	99 110	103 107	124 116

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY

TEMPERATURE (°C)

9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	[illegible]
102 105	122 114	89 105	94 106	81 77	87 103	81 103	93 106	77 96	75 93	80 90	68 82	75 85	67 82	71 94	77 83	73 88	63 88	64 88	67 82	66 82	57 81	61 81	[illegible]
104 110	125 119	92 108	97 110	83 105	89 105	83 107	95 110	79 100	77 95	83 95	76 87	78 91	72 87	76 99	82 00	77 93	69 93	65 90	68 84	67 85	60 84	62 83	[illegible]
104 110	126 119	92 109	97 110	83 80	89 106	83 108	95 110	79 100	78 96	83 93	75 87	78 92	72 87	76 100	82 90	77 93	68 94	65 90	68 85	66 85	59 83	61 83	[illegible]
105 110	126 119	93 109	97 110	84 81	90 107	84 108	96 110	79 100	78 96	84 95	76 88	79 92	73 87	77 100	83 95	78 93	69 94	66 90	68 85	67 86	60 85	63 84	[illegible]
103 108	124 116	89 105	95 105	81 76	82 103	82 105	93 106	76 96	75 92	81 92	74 85	77 89	71 84	75 96	80 87	76 90	66 91	62 88	55 81	59 80	47 80	38 79	[illegible]
111 107	131 116	100 105	103 107	88 77	88 103	91 105	102 107	87 96	84 92	89 92	84 84	86 89	81 84	85 95	91 87	84 89	77 91	70 87	60 81	66 80	51 80	39 78	[illegible]
102 108	123 116	89 105	94 107	81 77	81 103	82 106	93 106	76 96	74 92	80 92	73 84	78 89	70 84	75 95	80 87	75 90	66 91	61 87	54 81	57 80	45 80	34 79	46 81
103 109	125 118	90 107	95 109	81 79	81 105	83 108	93 108	77 98	75 94	81 94	76 87	78 91	73 86	77 100	82 90	76 92	68 91	61 89	54 82	57 81	44 81	35 79	45 81
103 107	125 116	91 105	95 107	81 76	81 103	83 107	94 107	77 96	75 92	81 92	77 85	78 90	73 84	77 98	82 88	76 91	68 90	61 87	54 81	57 79	44 79	34 78	45 79
103 107	125 116	89 105	95 107	80 76	81 103	83 107	93 107	76 96	74 92	81 92	76 85	78 90	73 84	77 98	82 88	76 90	68 91	61 86	54 81	57 79	44 79	34 78	45 79
103 107	124 116	89 105	95 107	81 76	81 102	83 107	93 107	76 96	74 92	81 92	76 85	78 89	73 84	77 98	82 87	76 91	68 91	61 87	54 81	57 79	45 79	34 78	45 79

EST (SHEET 36)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
9	80	70	71	48	72	70	63	64	70	69	13	19.5		71	42	40	36	21	18
5	96	99	107	72	103	103	87	93	94	98		22.5	5.3	65	43	37	35		
30	83	71	72	48	74	71	65	66	72	70	14	19.5		71	42	40	36	21	18
7	94	104	106	105	103	103	89	95	96	100		22.5	5.3	64	42	37	35		
30	83	70	73	49	73	71	65	65	72	70	14	19.5		71	42	40	36	21	18
7	97	104	106	105	103	103	89	95	97	100		22.5	5.5	64	42	37	35		
31	84	71	73	50	74	72	66	66	73	71	16	19.5		71	42	40	36	21	18
7	98	105	108	106	105	104	90	96	98	101		22.5	5.5	64	42	37	35		
56	81	67	65	46	63	62	53	59	62	60	16	19.2		70	42	40	36	21	18
5	95	104	105	71	104	104	86	93	95	99		22.8	5.4	64	42	37	35		
58	88	72	67	60	67	66	58	65	67	63	17	19.8		70	42	40	36	21	18
4	94	101	103	72	100	101	85	92	94	97		22.5	5.5	64	42	37	35		
54	80	67	63	45	61	60	51	53	59	58	17	18.9		71	42	40	36	21	18
04	94	101	103	71	101	101	85	92	94	97		22.5	5.4	64	42	37	35		
63	81	66	62	46	59	58	51	57	59	58	17	19.2		70	42	40	36	21	18
04	94	104	105	73	102	103	87	93	95	98		22.5	5.5	64	42	37	35		
63	81	65	62	46	59	58	51	57	60	58	15	19.2		70	42	40	36	21	18
03	94	102	104	71	100	102	85	92	94	96		22.5	5.4	64	42	37	35		
63	81	65	62	46	60	58	51	56	59	57	15	19.2		70	42	40	36	21	18
02	94	102	104	71	100	102	85	91	93	96		22.5	5.4	64	42	37	35		
63	81	65	62	46	60	58	51	56	59	57	15	19.2		70	42	40	36	21	18
03	94	102	104	71	100	102	85	91	93	96		22.5	5.4	64	42	37	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
1/10/73	17:10	175:56	2400	250	DUMMY TEST	60 86	108 90	100 118	114 122	85 118	107 115	92 111	99 110	103 107	124 116
1/10	17:40	176:26	2700	250	DUMMY TEST	59 86	108 90	100 119	115 122	86 119	108 115	93 112	100 110	103 108	125 116
1/10	18:10	176:56	2700	250	DUMMY TEST	59 86	108 90	100 119	115 122	86 119	108 115	93 110	100 110	103 108	126 117
						Stop	Change tail load to 425 H.P.								ins
1/10	19:30	177:26	3000	425	DUMMY TEST	56 96	108 89	100 120	114 124	86 120	108 116	93 112	100 112	104 110	125 118
						Stop	to correct tail load on power at								
1/10	20:10	177:56	3000	425	DUMMY TEST	57 94	109 87	100 119	116 123	88 118	110 114	95 111	102 110	106 108	128 116
1/10	20:40	178:26	3000	425	DUMMY TEST	57 94	109 87	100 119	116 123	88 118	111 115	95 112	102 110	106 108	129 117
1/10	21:10	178:56	3000	425	DUMMY TEST	56 93	109 87	99 119	116 123	88 118	111 116	95 112	102 110	106 108	12 11
1/10	21:40	179:26	3000	425	DUMMY TEST	57 93	109 87	101 119	116 123	88 118	111 116	95 108	102 110	106 108	12 11
1/10	22:10	179:56	3000	425	DUMMY TEST	57 93	109 87	100 119	116 123	88 118	111 116	95 112	103 110	106 108	12 11
1/10	22:25	180:11	1950	425	DUMMY TEST	56 93	109 86	101 118	116 122	87 117	109 113	93 110	101 109	104 106	12 11
1/10	22:55	180:41	3000	425	DUMMY TEST	56 93	109 87	100 119	116 123	88 118	111 116	95 112	103 110	106 108	12 11

ABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY BACK-TO-B

TEMPERATURE (°C)

12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
95	81	81	83	93	76	74	81	76	78	73	77	82	76	68	61	54	57	45	34	45	38	68	57
107	76	102	107	107	96	92	92	85	89	84	98	87	91	91	87	81	79	79	78	79	79	93	87
95	80	81	84	94	77	75	82	79	81	76	79	84	77	72	61	54	57	44	34	45	38	68	57
108	77	103	108	108	97	92	93	86	91	85	100	88	90	90	87	81	80	80	78	80	80	93	88
95	81	81	84	94	77	75	82	79	81	76	79	84	77	72	61	53	56	43	33	44	38	68	57
108	77	103	108	108	97	93	93	87	91	86	100	88	92	92	87	81	179	79	78	80	79	93	88
strainers			on power		at 19:00																		
95	80	81	84	94	77	75	82	78	80	76	79	84	78	74	63	56	60	46	35	47	39	71	58
109	78	105	110	110	97	95	94	88	92	88	101	90	93	93	88	84	82	82	81	83	82	94	87
97	83	83	86	97	80	78	85	80	81	78	82	86	80	76	65	58	63	48	37	49	41	73	59
108	76	103	109	108	96	93	93	87	91	86	99	88	92	92	88	84	82	81	81	83	82	94	88
98	83	83	86	97	80	78	85	80	81	79	82	87	80	76	65	58	63	48	36	49	41	73	60
108	76	103	109	108	96	93	93	87	91	85	100	88	92	92	88	84	82	81	81	83	82	94	88
98	83	83	86	97	80	78	85	81	81	79	82	86	80	76	65	58	62	48	35	48	41	73	60
108	76	103	109	108	96	93	93	87	90	86	99	88	92	92	88	84	82	81	81	83	82	94	88
98	83	83	86	97	80	78	85	81	82	79	82	86	80	76	65	57	62	48	36	48	41	73	60
108	76	103	109	108	96	93	93	87	91	86	99	88	92	92	88	84	82	81	81	83	82	94	88
98	83	83	86	97	80	78	85	82	82	79	82	87	80	76	65	58	62	48	35	48	41	73	60
108	76	103	109	108	96	93	93	87	91	86	99	88	92	92	88	84	83	81	81	83	82	94	88
96	82	82	84	96	79	77	83	77	79	74	79	83											
106	76	102	107	107	96	93	92	85	90	85	96	87											
98	83	83	87	97	80	78	85	83	85	80	83	87	80	76	65	58	62	48	35	48	40	72	59
108	76	103	110	109	96	93	93	87	91	86	100	88	93	93	88	84	83	81	81	83	82	95	88

TEST (SHEET 37)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
63	81	65	62	46	60	58	51	56	59	57	15	19.2		70	42	40	36	21	18
103	94	102	104	71	100	102	85	91	93	96		22.5	5.4	64	42	37	35		
62	82	65	62	46	59	58	50	56	59	57	14	19.2		70	42	40	36	21	18
102	95	103	104	72	101	102	85	92	94	97		22.5	5.4	64	42	37	35		
62	82	64	61	46	59	58	50	56	59	57	14	19.2		70	42	40	36	21	18
103	95	103	104	72	101	102	85	92	94	96		22.5	5.4	64	42	37	35		
63	83	65	61	48	59	58	51	57	59	59	13	19.5		70	42	40	36	21	18
100	95	104	103	74	96	101	85	93	94	95		22.5	5.4	64	42	37	34		
64	85	68	64	50	63	61	53	60	61	61	13	19.8		70	42	40	36	21	18
102	96	103	104	71	99	102	84	93	94	96		22.5	5.4	64	42	37	35		
65	85	68	64	50	62	61	52	59	62	61	13	19.8		70	42	40	36	21	18
103	96	104	104	71	99	102	85	93	94	96		22.5	5.4	64	42	37	34		
64	85	67	63	49	63	61	52	59	61	60	12	19.8		70	42	40	36	21	18
103	96	104	104	71	99	102	85	93	94	97		22.5	5.4	64	42	37	34		
64	85	66	63	50	63	61	52	59	61	61	12	19.8		70	42	40	36	21	18
103	96	103	103	71	99	102	85	93	94	96		22.5	5.4	64	42	37	34		
64	85	65	63	50	62	61	52	59	61	60	12	19.8		70	42	40	36	21	18
102	96	103	104	71	99	102	85	93	94	96		22.5	5.4	67	42	37	34		
												19.5		70	42	40	36	21	18
												22.5	5.4	64	42	37	34		
64	85	65	62	50	62	61	52	59	61	60	12	19.8		70	42	40	36	21	18
102	96	104	104	71	100	102	85	93	94	96		22.5	5.4	64	42	36	34		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
1/10/73	23:25	181:11	3000	425	DUMMY	55	109	100	117	88	111	95	103	106	12
					TEST	94	87	119	123	118	116	112	110	108	11
1/10	23:55	181:41	3000	425	DUMMY	55	109	100	117	88	111	95	103	106	12
					TEST	94	87	119	123	118	116	113	110	108	11
1/11	00:25	182:11	3000	425	DUMMY	55	109	100	117	88	111	95	103	106	12
					TEST	93	87	119	123	118	116	113	110	108	11
1/11	00:55	182:41	3000	425	DUMMY	54	109	100	116	88	111	95	102	106	12
					TEST	93	86	119	123	118	116	112	110	108	11
1/11	01:25	183:11	3000	425	DUMMY	54	109	100	116	88	111	95	102	106	12
					TEST	93	86	119	123	118	116	112	110	108	11
1/11	01:55	183:41	3000	425	DUMMY	54	109	100	116	88	111	95	102	106	12
					TEST	93	85	119	123	118	115	112	110	108	11
						Stop			end of shift						
1/11	05:30	183:41	1950	425	DUMMY	69	109	102	110	80	100	86	92	97	11
					TEST	98	91	116	121	112	110	107	106	103	11
1/11	05:45	183:56	1950	425	DUMMY	72	106	106	112	83	103	88	94	98	12
					TEST	100	93	117	122	113	112	110	108	105	11
1/11	06:15	184:26	3560	425	DUMMY	76	109	109	116	87	110	93	101	104	12
					TEST	105	97	122	125	120	119	114	112	110	11
1/11	06:30	184:41	1950	425	DUMMY	63	106	99	113	83	105	89	97	100	12
					TEST	93	85	119	123	118	115	110	107	110	11
1/11	07:00	185:11	3560	425	DUMMY	61	106	99	114	84	108	92	100	102	127
					TEST	94	85	120	124	121	118	114	112	110	11

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATC

TEMPERATURE (°C)

7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
95	103	106	129	94	98	83	83	87	97	80	78	85	83	85	80	83	87	81	76	65	58	62	48
.12	110	108	117	111	108	77	103	110	109	97	93	93	87	91	87	100	89	93	93	88	84	83	82
95	103	106	129	94	98	83	83	87	97	80	78	85	83	85	80	83	87	80	76	65	58	62	48
.13	110	108	117	107	108	77	103	110	109	97	93	93	87	91	87	100	89	92	92	88	84	83	82
95	103	106	129	94	98	83	83	87	97	80	80	86	83	85	80	83	87	80	76	65	57	62	47
13	110	108	117	106	108	77	103	110	109	97	93	93	88	91	87	100	89	92	92	88	84	83	82
95	102	106	129	94	98	83	82	87	97	79	78	85	83	85	80	83	87	80	76	64	57	61	46
12	110	108	117	107	108	77	103	110	108	97	93	93	87	91	87	100	89	93	93	89	84	82	81
95	102	106	128	94	97	83	82	86	97	79	77	85	83	85	80	83	86	80	76	64	56	61	45
12	110	108	117	108	108	77	103	109	108	96	93	93	87	91	86	100	89	92	92	88	84	82	81
95	102	106	128	94	97	83	82	86	97	79	77	85	83	85	80	83	86	80	76	64	56	61	45
12	110	108	117	108	108	77	103	109	108	96	93	93	87	91	86	100	89	92	92	88	84	82	81
36	92	97	116	82	88	72	78	77	88	72	70	72	63	64	61	65	69	69	60	64	72	71	60
07	106	103	112	102	104	74	101	101	105	93	89	85	79	82	79	90	80	84	84	84	84	85	82
38	94	98	120	85	91	76	82	79	90	73	72	75	65	70	63	69	72	72	62	62	67	65	56
10	108	105	114	103	105	76	102	105	105	95	92	88	81	85	81	94	84	87	87	84	81	82	80
93	101	104	129	90	97	82	88	86	96	78	77	84	82	86	80	82	86	80	79	64	69	67	59
14	112	110	119	109	110	79	107	112	111	99	96	96	92	95	90	102	93	97	96	89	85	87	84
39	97	100	123	87	92	79	79	81	91	72	72	78	69	70	70	76	79						
.0	107	110	116	105	107	77	103	107	108	96	95	94	86	90	85	99	87						
92	100	102	127	88	95	79	80	85	93	75	73	82	82	86	78	81	82	77	76	59	51	56	41
.4	112	110	118	110	110	79	105	112	110	98	95	95	92	96	89	102	92	96	95	90	85	84	82

ACK-TO-BACK TEST (SHEET 38)

																	PUMP			MANIF
																	FLOW			PRES
2	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H
.8	40	72	59	72	64	85	65	62	50	62	61	52	59	62	60	11	19.8		70	42	40
3	82	95	88	99	102	96	104	104	71	101	103	86	93	95	97		22.5	5.4	63	42	36
.8	40	72	59	72	63	85	66	62	50	63	61	52	59	61	60	11	19.8		70	42	40
3	82	95	88	99	103	96	104	104	71	101	102	85	93	94	97		22.5	5.4	63	42	36
7	39	72	59	72	63	85	66	62	50	62	60	51	59	61	60	10	19.8		70	42	40
3	82	95	88	99	103	96	104	104	71	101	102	85	93	94	97		22.5	5.4	63	42	36
7	39	72	58	72	63	85	66	62	49	61	60	51	58	61	59	9	19.8		70	42	40
3	82	95	88	99	102	96	104	104	71	101	102	85	93	94	97		22.5	5.4	63	42	36
6	38	72	58	72	63	84	67	61	49	61	60	51	58	61	59	9	19.8		70	42	40
3	82	94	88	99	102	96	104	104	71	100	103	85	93	94	96		22.5	5.4	63	42	36
6	38	72	58	72	63	84	66	61	49	61	60	51	58	61	59	9	19.8		70	42	40
3	82	94	88	99	102	96	104	104	71	100	103	85	93	94	96		22.5	5.4	63	42	36
2	63	71	62	72	66	72	68	62	39	62	62	56	60	65	66	9	18.3		71	42	40
6	85	89	83	90	89	91	95	95	69	89	91	80	89	89	85		22.5	5.4	65	43	37
8	59	70	62	72	76	77	68	67	42	68	65	58	61	67	67	8	18.6		71	42	40
2	81	91	84	94	97	93	98	100	70	94	96	82	91	92	92		22.5	5.4	65	43	37
1	63	72	65	73	79	86	70	70	47	70	68	62	64	70	69	8	19.5		71	42	40
5	84	95	90	99	104	97	106	106	74	95	98	88	95	96	97		22.5	5.4	64	42	36
																	18.3		71	42	39
																	22.5	5.4	64	42	36
2	33	68	53	68	60	82	63	57	43	57	56	47	54	57	55	7	18.0		71	42	40
4	83	95	89	99	102	96	106	106	73	101	104	87	94	95	97		[illegible]	5.4	63	41	36

EET 38)

9	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
5	62	50	62	61	52	59	62	60	11	19.8		70	42	40	36	21	18
4	104	71	101	103	86	93	95	97		22.5	5.4	63	42	36	34		
5	62	50	63	61	52	59	61	60	11	19.8		70	42	40	36	21	18
4	104	71	101	102	85	93	94	97		22.5	5.4	63	42	36	34		
5	62	50	62	60	51	59	61	60	10	19.8		70	42	40	36	21	18
4	104	71	101	102	85	93	94	97		22.5	5.4	63	42	36	34		
5	62	49	61	60	51	58	61	59	9	19.8		70	42	40	36	21	18
4	104	71	101	102	85	93	94	97		22.5	5.4	63	42	36	34		
7	61	49	61	60	51	58	61	59	9	19.8		70	42	40	36	21	18
4	104	71	100	103	85	93	94	96		22.5	5.4	63	42	36	34		
6	61	49	61	60	51	58	61	59	9	19.8		70	42	40	36	21	18
4	104	71	100	103	85	93	94	96		22.5	5.4	63	42	36	34		
8	62	39	62	62	56	60	65	66	9	18.3		71	42	40	36	21	18
5	95	69	89	91	80	89	89	85		22.5	5.4	65	43	37	35		
8	67	42	68	65	58	61	67	67	8	18.6		71	42	40	36	21	18
8	100	70	94	96	82	91	92	92		22.5	5.4	65	43	37	35		
0	70	47	70	68	62	64	70	69	8	19.5		71	42	40	36	21	18
6	106	74	95	98	88	95	96	97		22.5	5.4	64	42	36	34		
										18.3		71	42	39	35	20	17
										22.5	5.4	64	42	36	34		
3	57	43	57	56	47	54	57	55	7	18.9		71	42	40	36	20	18
6	106	73	101	104	87	94	95	97		22.5	5.4	63	41	36	34		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	
1/11/73	07:15	185:26	1950	425	DUMMY TEST	60 92	106 83	99 118	113 124	82 117	105 114	89 112	97 109	100 105	1 1
1/11	07:45	185:56	3560	425	DUMMY TEST	59 93	106 84	97 121	114 124	84 122	108 118	92 113	100 112	102 110	1 1
1/11	08:00	186:11	1950	425	DUMMY TEST	59 92	106 81	98 117	113 122	82 117	104 113	88 110	96 108	99 104	1 1
1/11	08:15	186:26	3700	425	DUMMY TEST	59 93	106 84	97 120	114 124	84 121	108 117	91 112	100 110	102 108	1 1
1/11	08:30	186:41	1950	425	DUMMY TEST	62 92	106 82	100 117	113 122	82 116	105 112	89 110	97 108	100 105	1 1
1/11	08:45	186:26	3700	425	DUMMY TEST	62 96	106 85	100 120	115 124	85 121	109 118	92 114	100 111	103 109	1 1
						Stop change tail load to 250 H.P.									
1/11	10:20	186:56	1100	250	DUMMY TEST	76 100	109 80	109 121	115 123	83 117	106 116	88 111	97 110	101 105	1 1
1/11	12:35	187:26	1100	250	DUMMY TEST	74 96	110 82	104 116	115 119	83 110	108 108	89 106	100 105	101 100	1 1
1/11	13:05	187:56	1100	250	DUMMY TEST	75 99	111 85	105 120	117 123	86 116	110 116	92 112	102 110	104 106	1 1
1/11	13:35	188:26	1100	250	DUMMY TEST	75 96	111 83	104 115	117 118	85 112	110 112	91 107	101 105	103 102	1 1
1/11	14:05	188:56	1950	250	DUMMY TEST	74 99	112 85	104 120	119 123	88 116	112 115	95 111	103 110	107 107	1 1

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY BA

TEMPERATURE (°C)

10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
122	86	92	78	78	81	92	73	72	78	71	75	70	75	78								
116	115	107	77	103	106	107	97	94	93	85	90	85	97	87								
127	88	95	80	80	86	93	75	73	83	83	83	79	81	85	78	77	59	52	56	41	39	41
119	118	110	78	105	112	110	98	95	96	93	97	90	102	95	96	95	90	85	84	82	81	84
121	85	92	78	77	81	92	72	72	78	71	74	68	73	76								
115	110	105	75	102	105	106	95	92	91	83	87	83	96	85								
126	88	94	78	79	85	93	74	73	81	82	81	77	80	83								
116	109	109	78	104	111	109	97	93	94	91	95	89	101	92								
122	85	92	78	79	80	91	72	71	77	70	74	66	72	76								
115	113	106	76	102	105	106	95	92	91	83	87	82	95	85								
127	89	95	79	80	86	94	75	73	82	83	84	78	81	85								
117	110	110	78	105	112	110	97	94	94	94	96	90	102	93								
	Inspect strainers				Test and Dummy on power						10:20											
121	88	93	78	82	81	93	78	76	78	69	74	67	72	76	72	65	71	58	62	49	38	51
117	107	108	80	105	104	108	98	92	89	85	86	85	95	85	89	89	88	84	82	82	82	84
121	89	93	77	79	81	92	77	73	77	68	75	66	71	75	73	63	65	56	60	47	37	48
110	102	102	72	100	100	102	91	88	83	77	80	77	89	78	82	82	82	77	75	75	75	77
125	94	98	83	83	85	97	81	78	83	78	80	71	76	82	77	68	67	57	61	48	37	48
117	114	109	79	104	105	108	97	95	90	84	86	85	95	85	90	90	90	83	80	80	79	81
124	92	95	83	83	84	96	80	77	82	73	80	70	75	81	76	67	66	57	61	48	48	48
113	110	105	75	100	102	105	95	92	87	81	82	80	90	82	85	85	85	86	79	76	76	74
128	96	100	85	85	88	98	83	80	86	80	83	78	80	87	81	72	67	58	62	49	37	49
116	116	108	78	103	106	107	97	93	90	84	87	84	98	87	90	90	89	81	79	79	77	79

CK TEST (SHEET 39)

36	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
													18.3		71	42	39	35	21	18
													22.5	5.4	64	42	36	34		
65	59	82	62	56	43	55	54	46	53	57	54	5	18.9		71	42	40	36	21	18
99	102	98	106	106	74	102	10[illegible]	88	94	95	98		22.5	5.4	63	41	36	34		
													18.3		71	42	39	35	21	17
													22.5	5.4	64	42	36	34		
													18.9		70	42	39	35	21	17
													22.5	5.4	63	41	36	33		
													18.3		70	42	39	35	21	17
													22.5	5.4	64	42	36	34		
													18.9		70	42	40	36	21	17
													22.5	5.4	64	41	36	34		
73	68	79	70	67	49	67	65	58	63	65	63	17	19.8		70	42	40	36	21	18
95	95	95	99	99	76	93	97	85	92	92	93		22.5	5.5	64	42	37	35		
72	65	78	70	63	51	64	62	55	62	62	61	18	19.2		70	43	40	37	21	18
90	93	89	94	95	67	90	93	78	87	89	89		22.5	5.3	65	42	37	35		
74	67	82	70	66	53	68	66	57	63	64	62	15	20.1		70	42	40	36	21	18
98	103	96	101	105	76	98	102	87	93	94	95		22.8	5.5	64	42	36	34		
73	66	82	69	66	52	67	66	56	62	63	62	16	19.2		70	42	40	36	21	18
87	104	93	97	104	69	96	99	82	90	93	95		22.2	5.4	64	42	36	34		
75	67	85	69	66	54	69	67	58	64	64	63	16	20.1		70	42	40	37	21	18
99	104	95	102	105	73	99	102	85	92	94	98		22.5	5.4	64	42	37	34		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	
1/11/73	14:35	189:26	1950	250	DUMMY TEST	75 99	112 85	103 120	118 124	89 116	112 115	95 111	104 110	107 107	12 11
1/11	15:05	189:56	1950	250	DUMMY TEST	75 99	112 85	103 119	118 123	89 116	113 115	95 111	104 109	107 106	12 11
1/11	15:35	190:26	1950	250	DUMMY TEST	74 99	111 85	104 119	118 123	89 115	112 115	94 110	103 109	106 105	12 11
1/11	16:05	190:56	1950	250	DUMMY TEST	74 98	111 85	103 118	117 123	88 115	111 115	94 110	103 109	106 106	12 11
1/11	16:35	191:26	1950	250	DUMMY TEST	74 98	111 84	103 118	117 123	88 115	111 115	94 109	103 108	105 105	12 11
1/11	17:05	191:56	1950	250	DUMMY TEST	75 98	111 85	104 118	117 123	88 115	111 115	94 110	103 108	106 105	12 11
1/11	17:35	192:26	1950	250	DUMMY TEST	75 98	111 84	104 118	117 123	88 115	111 115	94 109	103 108	106 105	12 11
1/11	18:05	192:56	1950	250	DUMMY TEST	74 98	111 85	104 118	118 123	88 115	112 115	94 110	103 108	106 105	128 115
1/11	18:35	193:26	1950	250	DUMMY TEST	74 97	111 85	105 118	118 123	89 115	112 115	94 110	103 108	106 105	128 115
1/11	19:05	193:56	2400	250	DUMMY TEST	74 98	111 85	104 120	118 124	89 117	112 117	95 112	104 111	106 108	129 117
1/11	19:35	194:26	2400	250	DUMMY TEST	74 98	110 85	103 120	117 124	88 117	111 116	94 112	103 111	105 108	128 117

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY BACK-

TEMPERATURE (°C)																							
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
129	96	100	86	85	88	98	83	80	87	80	85	77	80	87	81	73	67	58	62	49	38	49	42
116	115	108	78	103	107	107	97	93	90	84	88	84	98	87	90	90	88	81	78	77	79	79	79
129	96	100	85	86	88	98	87	80	86	80	83	77	80	87	80	72	67	58	62	49	38	49	42
116	115	107	77	103	106	107	97	92	90	84	87	83	97	86	89	89	88	81	78	78	76	79	78
129	95	99	85	85	87	97	82	79	85	79	83	76	79	86	80	72	66	57	61	48	37	49	42
115	115	107	77	103	106	107	96	92	90	84	87	83	97	86	89	89	87	80	78	78	76	79	78
128	95	99	85	85	87	97	82	79	85	79	83	76	79	86	79	71	65	58	61	49	37	49	41
116	110	107	76	103	106	106	96	92	89	83	87	83	96	86	89	89	87	80	78	78	76	78	78
128	94	98	85	84	87	97	81	79	84	79	84	75	78	86	79	71	65	57	61	48	37	48	41
115	114	107	76	102	106	106	95	91	89	82	87	82	96	85	89	89	87	80	77	78	76	78	77
128	94	98	85	85	87	97	81	79	84	79	84	75	78	86	79	71	65	57	61	48	37	48	41
115	114	107	76	102	106	106	95	91	89	82	86	82	96	85	88	89	87	80	78	78	75	78	71
128	94	98	85	85	87	97	81	79	84	79	84	75	78	86	79	71	65	57	61	48	37	48	41
115	114	107	76	102	106	106	95	91	89	82	86	82	96	85	88	88	87	80	78	78	75	78	77
128	95	99	85	85	87	97	82	79	85	79	84	76	79	86	79	71	65	57	61	48	36	48	41
115	114	107	76	103	105	106	95	92	89	83	86	83	96	85	88	88	87	79	77	77	75	78	77
128	95	99	85	85	87	97	82	80	85	79	85	76	79	86	79	71	66	56	61	48	36	48	41
115	114	107	76	103	105	106	95	92	89	83	87	82	96	85	88	88	86	79	77	77	75	77	77
29	95	99	85	85	87	97	81	79	86	82	87	79	82	88	81	76	65	56	60	48	36	48	40
17	116	110	78	105	109	109	97	93	92	86	90	85	98	88	91	91	88	81	78	78	77	79	78
28	94	98	85	84	87	97	81	79	85	81	87	78	81	88	80	74	64	56	60	47	36	47	40
17	116	110	78	105	109	109	97	93	92	86	90	86	98	88	91	91	89	82	79	78	77	79	79

TEST (SHEET 40)

												PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
												FLOW							
37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
67	86	70	67	54	68	66	58	64	64	63	17	20.1		70	42	40	36	21	18
104	94	102	105	73	99	102	85	92	93	97		22.5	5.4	64	42	37	34		
67	85	68	67	53	68	66	58	63	64	63	17	20.1		70	42	40	36	21	18
104	95	101	104	72	99	102	85	92	93	97		22.5	5.4	64	42	37	34		
67	85	68	67	53	68	66	58	63	64	62	17	19.8		70	42	40	36	21	18
104	94	101	105	72	98	102	85	91	93	97		22.5	5.4	64	42	37	34		
66	84	68	66	52	67	65	57	63	64	62	16	19.8		70	42	40	36	21	18
104	94	101	104	72	98	102	85	91	93	97		22.5	5.4	64	42	37	34		
66	84	68	65	52	67	65	56	62	63	61	16	19.8		70	42	40	36	21	18
104	94	101	104	71	98	101	85	91	93	96		22.5	5.4	64	42	37	34		
66	84	68	65	52	67	65	56	63	63	61	17	19.8		70	42	40	36	21	18
103	94	101	104	71	98	101	85	91	93	96		22.5	5.4	64	42	37	34		
66	84	68	65	52	66	65	56	63	62	61	17	19.8		70	42	40	36	21	18
103	94	101	104	71	98	101	85	91	93	96		22.5	5.4	64	42	37	34		
66	84	68	66	52	67	65	56	63	63	62	17	19.8		70	42	40	36	21	18
103	94	101	104	71	98	101	84	91	93	96		22.5	5.4	64	42	37	34		
66	84	68	66	52	67	65	56	63	64	62	16	19.8		70	42	40	36	21	18
103	93	100	104	70	97	100	84	91	92	96		22.5	5.4	64	42	37	34		
66	85	67	66	51	67	65	56	63	63	61	15	19.8		70	42	40	36	21	18
104	95	103	107	72	99	104	86	92	94	97		22.5	5.4	64	42	36	34		
65	85	67	65	51	66	64	55	61	62	60	14	19.8		70	42	40	36	21	18
104	95	104	107	73	100	104	86	93	94	98		22.5	5.4	64	41	36	34		

						TA										
DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10	11
1/11/73	20:5	194:56	2400	250	DUMMY TEST	74 98	110 85	103 120	117 124	88 117	111 117	94 113	103 111	105 108	128 117	94 116
1/11	20:35	195:26	2400	250	DUMMY TEST	74 98	110 85	103 120	117 124	88 117	111 117	94 113	103 111	105 108	128 117	94 116
1/11	21:05	195:56	2400	250	DUMMY TEST	74 98	110 85	103 120	117 124	88 117	111 116	94 113	103 111	105 108	128 117	93 116
1/11	21:35	196:26	2700	250	DUMMY TEST	73 97	110 86	103 120	117 124	88 117	112 117	94 113	103 111	106 108	129 117	94 116
1/11	22:05	196:56	2700	250	DUMMY TEST	73 97	110 86	103 120	117 124	88 117	112 117	94 113	103 111	106 108	129 117	94 116
						Stop increase tail load to 425 H.P. Inspec										
1/11	23:35	197:26	3000	425	DUMMY TEST	71 101	109 75	102 120	116 123	87 117	111 115	94 112	103 110	105 108	130 116	94 114
1/12	00:05	197:56	3000	425	DUMMY TEST	71 101	109 74	102 119	116 123	87 117	111 117	94 113	103 110	105 108	130 117	93 116
1/12	00:35	198:26	3000	425	DUMMY TEST	70 101	109 74	101 119	116 123	86 117	111 117	94 112	103 110	105 108	129 117	93 116
1/12	01:05	198:56	3000	425	DUMMY TEST	70 101	109 74	101 119	116 123	86 117	111 117	93 112	103 110	105 107	130 117	93 116
1/12	01:50	199:41	3000	425	DUMMY TEST	71 100	109 74	102 119	117 123	86 117	111 116	94 112	103 110	105 107	130 117	93 116
						Stop End of shift Restart 1st shift										
1/12	03:55	199:56	3000	425	DUMMY TEST	80 106	108 85	108 121	115 125	85 118	109 117	91 113	100 112	103 109	128 117	92 114

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY BACI

TEMPERATURE (°C)																							
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
128	94	98	84	84	87	97	81	79	85	81	87	78	81	86	80	73	64	56	59	47	35	46	39
117	116	110	78	105	109	109	97	93	92	85	90	86	98	88	91	91	89	81	78	78	77	79	78
128	94	98	84	84	87	97	81	79	85	81	87	78	81	86	80	73	64	56	59	47	35	46	39
117	116	110	78	105	109	109	97	93	92	85	90	86	98	88	91	91	89	81	78	78	77	79	78
128	93	98	84	84	87	96	81	78	85	80	86	77	80	87	79	73	64	55	59	46	35	46	39
117	116	110	78	105	109	109	98	93	92	86	90	86	98	89	91	91	89	81	79	78	77	79	78
129	94	98	84	84	87	97	81	78	86	83	89	80	83	87	80	76	64	55	59	45	34	46	39
117	116	109	78	105	110	109	97	93	92	87	91	87	99	88	91	92	88	81	79	78	76	79	78
.29	94	98	84	84	87	97	81	78	86	83	89	80	82	87	80	76	64	56	59	45	34	46	39
.17	116	109	78	105	110	109	97	93	92	87	91	87	99	88	91	92	88	81	79	78	76	78	78
Inspect strainers test and dummy. On power at 23:05																							
.30	94	98	84	82	87	97	79	77	85	81	86	79	81	87	80	76	65	58	62	48	36	48	40
.16	114	108	77	104	110	108	96	94	91	86	90	85	98	87	91	91	87	81	80	79	78	81	80
30	93	98	83	82	87	97	79	77	85	81	86	79	81	87	80	75	64	58	62	48	35	47	40
17	116	109	77	104	110	109	96	94	91	86	90	86	98	87	91	91	87	82	80	80	78	81	80
29	93	98	83	81	87	97	79	77	85	81	86	79	82	86	80	75	64	57	61	46	34	47	39
17	116	109	77	104	109	108	96	94	91	86	90	86	98	88	91	91	88	82	80	80	78	82	81
30	93	98	83	81	86	97	79	78	85	81	86	79	82	86	80	75	64	57	61	46	34	47	39
17	116	109	77	104	109	108	96	94	90	86	90	86	98	88	91	91	88	82	80	80	78	82	81
30	93	98	83	82	87	97	79	78	85	82	87	79	82	87	80	75	64	58	61	47	34	47	39
17	116	109	77	104	109	108	96	94	91	86	90	86	98	89	91	91	88	82	80	80	78	81	80
t shift On power 05:40																							
.8	92	96	82	86	85	95	78	77	83	78	82	76	79	85	78	74	66	70	69	61	62	62	65
.7	114	110	79	105	111	110	98	93	92	88	92	87	100	89	92	91	88	84	84	82	81	84	82

EST (SHEET 41)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
64	84	66	64	51	66	64	55	61	62	60	14	19.8		70	42	40	36	21	18
03	95	103	106	72	99	103	87	92	94	98		22.5	5.4	63	41	36	34		
64	84	66	64	51	66	64	55	61	62	60	14	19.8		70	42	40	36	21	18
.03	95	103	106	72	99	103	87	92	94	98		22.5	5.4	63	41	36	34		
64	84	66	64	50	65	63	54	60	61	60	14	19.8		70	42	40	36	21	18
103	95	104	106	72	99	104	87	92	94	98		22.5	5.4	63	41	36	34		
64	85	68	63	50	65	64	64	54	61	61	14	19.8		70	42	40	37	21	18
103	95	104	106	72	99	104	87	92	94	98		22.5	5.4	64	42	36	34		
64	85	68	63	50	65	64	54	61	61	60	14	19.8		70	42	40	37	21	18
103	95	104	106	72	99	104	87	92	94	98		22.5	5.4	64	42	36	34		
64	85	68	63	49	64	62	53	61	62	60	12	19.8		70	42	40	36	21	18
101	95	104	106	71	98	103	85	93	94	95		22.5	5.4	63	42	36	34		
64	84	67	63	49	62	61	52	60	61	60	12	19.8		70	42	40	36	21	18
102	95	104	107	72	99	104	86	93	95	95		22.5	5.4	63	42	36	34		
63	84	67	62	49	61	60	52	59	61	59	10	19.8		70	42	40	36	21	18
102	95	104	107	72	99	104	86	93	95	96		22.5	5.4	63	42	36	34		
63	84	67	62	49	60	60	52	59	61	59	10	19.8		70	42	40	36	21	18
102	95	104	107	72	99	104	86	93	94	96		22.5	5.4	63	42	36	34		
65	84	67	62	49	61	60	52	59	61	59	11	19.8		70	42	40	36	21	18
102	95	104	107	72	99	104	86	93	95	95		22.5	5.4	63	42	36	34		
79	84	73	72	47	72	70	63	66	70	70	11	19.8		71	42	40	36	21	18
103	96	104	106	74	100	102	87	94	95	96		22.5	5.5	64	42	37	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
1/12/73	06:10	200:11	1950	425	DUMMY TEST	74 100	107 77	102 120	113 123	83 116	106 116	90 112	98 110	101 108	12 11
1/12	06:40	260:41	3000	425	DUMMY TEST	70 100	107 77	100 120	114 124	84 118	108 118	91 114	100 112	102 109	12 11
1/12	07:10	201:11	3000	425	DUMMY TEST	70 100	107 77	100 120	115 124	84 118	108 118	91 113	100 112	103 109	12 11
1/12	07:40	201:41	3000	425	DUMMY TEST	70 100	107 76	100 120	115 124	84 118	109 118	92 113	100 110	103 109	12 11
1/12	08:10	202:11	3000	425	DUMMY TEST	70 100	108 75	101 120	115 124	84 117	109 117	92 112	101 110	103 109	12 11
1/12	08:40	202:41	3000	425	DUMMY TEST	70 100	108 75	101 120	115 124	83 118	109 118	92 112	101 110	103 109	12 11
1/12	09:10	203:11	3000	425	DUMMY TEST	70 100	108 75	101 120	116 124	85 118	110 118	93 112	102 110	104 109	12 11
1/12	09:40	203:41	3000	425	DUMMY TEST	70 99	108 75	101 120	116 124	85 118	110 118	93 112	102 110	104 109	12 11
1/12	09:55	203:56	1950	425	DUMMY TEST	70 98	108 73	101 118	114 122	118 115	110 113	93 110	99 108	102 105	12 11
1/12	10:25	204:26	3560	425	DUMMY TEST	70 100	108 76	101 121	116 124	86 120	111 120	94 114	113 113	105 110	13 11
						Shut down to clean slip rings on powe									
1/12	11:00	204:41	1950	425	DUMMY TEST	72 99	109 74	102 117	116 121	85 114	108 112	92 107	101 106	103 104	12 11

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY BACK-TO-

												TEMPERATURE (°C)												
1	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
8	93	80	80	82	93	76	75	80	72	77	71	76	81	75	66	63	60	63	49	37	50	42	72	
7	109	78	105	108	109	98	94	92	85	90	85	99	88	92	93	90	84	84	82	81	85	84	95	
0	95	80	80	84	93	76	74	82	77	83	76	79	83	77	72	62	57	60	46	33	46	39	70	
6	110	79	105	110	110	98	94	92	88	92	87	100	90	92	93	90	83	82	81	79	83	82	94	
0	95	81	80	85	94	77	75	82	78	83	76	79	84	77	73	62	57	60	47	34	46	39	70	
7	110	79	105	111	110	98	94	92	88	92	87	100	90	93	92	90	84	82	81	79	83	82	95	
0	96	81	80	85	95	77	76	82	80	85	77	80	85	77	73	62	56	60	46	33	46	38	70	
7	110	78	105	110	110	98	93	92	87	91	87	99	89	92	93	89	83	81	81	79	83	82	94	
1	96	82	80	85	95	78	76	83	80	85	77	80	85	78	73	62	57	60	47	34	46	38	70	
5	110	78	105	110	109	97	94	91	87	91	87	99	93	92	92	89	83	81	81	79	82	81	94	
1	96	81	80	85	95	78	76	83	80	85	77	80	85	78	73	62	58	60	47	34	46	38	70	5
7	110	78	105	110	109	97	94	92	87	91	87	99	93	93	93	89	84	81	81	79	82	82	95	9
	97	82	80	86	96	78	76	84	81	87	77	81	86	78	74	63	58	61	47	34	46	39	71	5
	110	78	105	110	109	97	94	92	87	91	87	99	91	92	92	89	84	81	81	79	82	82	94	9
	97	82	80	86	96	78	76	84	81	85	78	81	85	78	74	63	58	61	48	34	46	39	71	5
	110	78	105	110	109	97	94	92	87	92	87	99	96	92	92	89	83	81	81	79	82	81	94	8
	95	81	79	83	93	77	75	80	74	79	71	76	80	74	66	62	58	61	48	33	46	38	70	5
	111	76	104	106	107	96	92	89	83	87	83	96	91	89	90	87	82	81	80	78	81	81	93	8
	98	83	81	88	97	80	78	86	86	91	82	86	87	81	79	63	58	62	49	35	47	40	71	5
	112	79	106	114	111	98	96	94	92	97	91	102	92	96	96	90	84	82	82	79	83	82	95	9
0:45																								
	96	82	81	85	95	79	78	81	72	77	71	75	80	76	67	65	62	65	51	38	50	43	74	6
	110	75	101	105	105	95	90	87	81	83	80	94	83	85	85	85	80	79	78	76	80	79	91	8

'EST (SHEET 42)

												PUMP			MANIFOLD			DUMMY INPUT PRESS	
												FLOW			PRESS				
37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
59	82	71	67	45	67	64	55	62	63	62	17	19.2		71	42	40	36	21	18
05	97	104	110	74	101	106	87	95	96	98		22.5	5.4	64	42	37	35		
63	88	69	62	45	59	60	51	58	60	58	13	19.2		71	42	40	36	21	18
05	96	105	110	73	102	106	88	94	94	98		22.5	5.4	63	42	36	34		
63	82	69	61	46	59	58	50	58	59	58	12	19.2		71	42	40	36	21	18
04	96	105	110	73	102	106	87	94	94	98		22.5	5.4	63	42	36	34		
62	82	69	61	46	59	58	50	58	59	59	10	19.2		71	42	40	36	21	18
04	96	105	110	73	101	106	87	94	94	98		22.5	5.4	64	42	36	34		
62	82	69	61	46	58	57	50	58	59	58	10	19.2		71	42	40	36	21	18
04	96	104	110	73	101	106	87	94	91	98		22.5	5.4	64	42	37	34		
62	82	69	61	46	58	58	50	58	59	58	10	19.2		71	42	40	36	21	18
04	96	105	110	73	102	106	87	94	94	98		22.5	5.4	64	42	37	34		
63	83	69	62	47	60	58	51	58	60	58	11	19.5		71	42	40	36	21	18
04	96	105	110	73	101	106	87	94	94	98		22.5	5.5	64	42	37	34		
62	83	69	61	47	61	59	50	58	60	58	10	19.2		71	42	40	36	21	18
04	96	105	110	73	102	106	87	94	94	98		22.5	5.4	64	42	37	10		
62	80	69	61	45	61	59	50	58	59	58	10	19.2		71	42	40	36	21	18
03	95	101	110	71	100	106	86	93	94	97		22.5	5.4	64	42	37	35		
62	85	70	62	48	61	48	61	59	51	58	10	19.5		71	42	40	36	21	18
03	98	107	111	74	102	107	89	95	96	98		22.5	5.4	63	41	36	34		
66	81	73	65	48	65	63	53	62	63	62	12	19.5		71	42	40	36	21	18
01	93	99	106	72	96	104	82	91	92	94		22.5	5.4	65	42	37	34		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
1/12/73	11:30	205:11	3560	425	DUMMY TEST	72 102	111 77	103 121	118 124	89 119	115 119	96 114	111 112	108 110	133 119
1/12	11:45	205:26	1950	425	DUMMY TEST	74 100	110 75	103 119	107 123	87 115	110 115	93 110	102 109	105 106	128 116
1/12	12:15	205:56	3560	425	DUMMY TEST	72 102	111 76	103 121	118 124	89 120	114 119	96 115	106 112	108 110	133 118
1/12	12:30	206:11	1950	425	DUMMY TEST	74 100	110 75	103 118	117 122	87 115	110 114	93 110	102 109	105 106	128 116
1/12	12:45	206:26	3700	425	DUMMY TEST	84 101	110 76	102 120	118 124	89 119	113 119	96 114	105 112	107 110	132 118
1/12	13:00	206:41	1950	425	DUMMY TEST	75 101	111 75	103 119	117 123	88 116	111 115	94 110	103 110	105 107	128 117
1/12	13:15	206:56	3700	425	DUMMY TEST	73 102	110 76	103 120	118 124	89 119	113 118	96 114	105 112	107 110	132 118
						Stop for inspection of chip detectors									

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABOR

TEMPERATURE (°C)

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
15	96	111	108	133	97	101	86	84	90	100	83	82	89	88	93	86	89	92	84	82	67	63	67
19	114	112	110	119	118	111	79	107	113	110	99	95	93	92	95	90	102	91	95	96	89	84	82
10	93	102	105	128	93	98	84	82	85	97	81	80	85	77	83	76	81	85					
15	110	109	106	116	115	107	76	103	106	107	96	92	90	84	88	83	97	85					
14	96	106	108	133	96	101	85	84	90	100	83	82	90	89	94	86	88	92	84	83	68	63	68
19	115	112	110	118	118	110	79	105	113	111	99	95	95	92	96	91	102	92	95	96	89	84	82
10	93	102	105	128	93	98	83	82	86	97	82	80	85	77	83	76	81	86					
14	110	109	106	116	115	107	77	103	106	107	97	92	90	84	88	83	97	86					
3	96	105	107	132	96	100	84	83	90	99	83	81	88	89	94	84	88	89					
9	114	112	110	118	117	110	79	105	112	110	98	93	92	88	95	90	100	91					
1	94	103	105	123	93	98	84	83	86	97	82	81	86	79	85	78	82	87					
5	110	110	107	117	115	108	77	105	107	108	97	93	91	85	89	84	98	87					
3	96	105	107	132	96	100	83	83	90	99	83	81	88	89	94	84	88	90					
8	114	112	110	118	118	110	79	105	113	110	98	94	92	91	95	90	101	92					

f chip detectors

TEST (SHEET 43)

													PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
													FLOW							
6	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
7	67	89	76	67	52	65	63	56	63	63	64	13	19.8		71	42	41	37	21	18
0	104	96	106	109	73	100	106	87	94	95	98		22.5	5.4	63	41	36	34		
													19.5		70	42	40	36	21	18
													22.5	5.4	64	42	34	35		
7	66	89	76	66	53	64	63	55	63	64	63	13	20.1		70	42	40	37	21	18
0	104	97	106	109	74	101	106	88	94	95	98		22.5	5.4	63	41	36	34		
													19.8		70	42	40	36	21	18
													22.5	5.4	64	42	37	35		
													19.8		70	42	41	37	21	18
													22.5	5.4	63	41	36	34		
													19.8		70	42	40	36	21	18
													22.5	5.4	64	42	37	35		
													20.1		71	42	41	37	21	18
													22.5	5.4	64	42	36	34		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
						No load test Start 100% R.P.M.									
1/15 /73	18:35	206:56	0	0	DUMMY TEST	74 65	108 65	96 73	110 72	8[illegible] 77	106 90	89 79	97 78	102 81	117 89
1/15	19:05	206:56	0	0	DUMMY TEST	76 67	114 67	101 70	115 69	92 70	110 89	92 75	100 70	105 79	120 87
						Stop check strainers restart 100% R.									
1/15	20:45	206:56	0	0	DUMMY TEST	68 52	109 57	94 62	111 60	80 63	104 83	87 66	95 65	98 71	114 79
1/15	21:15	206:56	0	0	DUMMY TEST	67 53	110 58	94 64	111 62	80 65	104 84	87 66	95 66	99 72	114 81
						Stop check strainers start 100% R.									
1/15	22:00	206:56	0	0	DUMMY TEST	67 51	109 56	93 62	110 60	79 63	104 82	86 65	94 65	98 70	113 78
1/15	22:30	206:56	0	0	DUMMY TEST	67 53	109 58	93 65	111 63	79 66	104 85	87 68	94 67	98 73	114 80
						Stcp check strainers start 100% R.P.M									
1/15	23:30	206:56	0	0	DUMMY TEST	68 51	111 56	95 62	113 60	82 66	107 83	90 64	98 65	101 70	117 79
						Stop and check strainers									

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY B

											TEMPERATURE (°C)											
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
100% R.P.M. at 18:05																						
102	117	91	95	82	88	82	93	84	79	80	72	77	68	74	78	75	67	76	70	68	55	45
81	89	90	93	76	92	100	98	92	86	74	78	79	78	78	78	77	76	80	70	71	70	65
105	120	95	98	85	90	86	97	90	83	83	76	80	71	77	82	78	71	80	74	71	58	49
79	87	87	90	72	90	96	94	89	84	74	74	76	74	75	75	78	78	79	70	69	69	65
rt 100% R.P.M at 20:15																						
98	114	88	92	81	77	81	91	84	83	76	69	74	64	70	75	72	64	67	54	53	30	24
71	79	79	83	64	82	93	89	82	77	66	67	68	67	68	68	70	70	71	58	60	60	54
99	114	88	93	81	77	81	92	83	77	77	69	74	65	71	75	72	64	67	53	53	30	22
72	81	80	84	66	83	94	90	83	78	68	69	70	69	70	70	72	72	74	60	62	63	55
rt 100% R.P.M at 21:30																						
98	113	88	92	79	76	80	91	82	76	76	68	74	63	70	74	71	63	66	52	52	29	21
70	78	79	82	64	82	93	89	81	76	66	67	69	67	68	68	70	71	71	58	59	61	54
98	114	87	92	79	76	81	91	82	76	76	68	74	64	71	75	71	63	66	52	52	28	20
73	80	81	84	66	84	95	90	83	78	69	69	71	70	71	70	73	73	74	60	62	63	55
; 100% R.P.M. at 23:00																						
101	117	91	95	83	78	84	94	86	78	79	68	77	67	73	78	75	67	69	54	54	29	21
70	79	79	83	64	82	93	89	82	76	66	67	69	67	69	68	70	70	71	58	60	60	53

TEST (SHEET 44)

6	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
5	81	80	72	73	46	74	73	68	67	73	73	17	19.8		69	41	39	36	21	18
1	87	85	81	74	74	71	72	59	90	74	68		22.5	5.5	65	42	37	35		
2	83	85	76	76	59	80	78	73	73	77	78	16	20.7		69	41	39	36	21	18
5	92	85	79	81	70	78	79	49	84	79	71		22.5	5.4	65	42	37	35		
1	65	77	59	63	52	64	62	53	70	61	60	16	19.8		69	41	39	17	21	18
7	81	77	71	69	63	57	67	54	77	66	60		21.9	5.2	64	42	37	34		
1	64	77	60	62	52	63	61	53	70	61	60	14	19.8		69	41	38	36	21	18
9	84	79	74	71	66	57	70	58	78	66	60		21.9	5.2	64	42	37	34		
0	63	76	63	59	51	62	60	51	69	59	58	13	19.5		70	41	39	37	21	18
8	82	77	72	71	63	57	69	61	76	66	60		21.6	5.1	64	42	37	34		
0	63	76	63	59	51	62	60	51	69	59	58	12	19.8		70	41	39	36	21	18
0	84	79	74	74	66	57	71	91	78	66	60		21.9	5.2	64	42	37	35		
2	64	80	65	63	56	64	62	53	71	61	61	12	19.8		70	41	39	36	21	18
9	85	78	72	71	63	58	68	66	77	66	60		21.9	5.2	64	42	37	34		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	
1/16/73	08:05	206:56	1100	250	DUMMY TEST	76 98	117 72	105 112	119 116	92 107	115 107	97 101	107 102	110 97	
1/16	08:35	207:26	1100	250	DUMMY TEST	72 95	113 70	97 115	114 119	89 110	111 111	93 108	102 105	106 100	1 1
1/16	09:05	207:56	1100	250	DUMMY TEST	69 97	112 72	95 115	112 119	88 111	108 112	91 99	101 106	103 102	1 1
1/16	09:35	208:26	1100	250	DUMMY TEST	70 99	112 72	96 116	113 120	88 112	109 113	91 110	101 107	103 102	1 1
1/16	10:05	208:56	1950	250	DUMMY TEST	71 101	112 75	96 120	115 124	90 117	111 118	95 115	103 112	106 109	1 1
1/16	10:35	209:26	1950	250	DUMMY TEST	71 100	111 73	95 117	114 121	89 114	109 114	93 111	101 108	105 105	1 1
1/16	11:05	209:56	1950	250	DUMMY TEST	71 99	111 73	95 116	114 121	88 113	108 113	93 110	101 107	104 105	1 1
1/16	11:35	210:26	1950	250	DUMMY TEST	71 99	111 73	95 116	113 121	88 112	109 112	92 109	101 105	104 104	1 1
1/16	12:05	210:56	1950	250	DUMMY TEST	71 99	111 73	95 116	113 120	89 112	109 112	93 109	101 106	105 104	1 1
1/16	12:35	211:26	1950	250	DUMMY TEST	72 100	111 73	95 117	113 121	89 114	109 114	93 108	101 107	104 105	1 11
1/16	13:05	211:56	1950	250	DUMMY TEST	73 100	111 74	96 117	114 122	89 114	109 114	93 110	101 109	105 106	1 11

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORAT

TEMPERATURE (°C)

7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	3
97	107	110	130	97	101	85	90	88	99	87	85	86	79	82	78	82	85	82	76	84	79	78	6
101	102	97	107	105	99	68	93	97	99	86	82	78	72	75	73	85	81	77	77	77	69	72	6
93	102	106	126	93	98	85	85	85	97	82	79	85	76	80	72	78	84	75	69	70	58	58	4
108	105	100	110	110	100	73	96	102	102	90	88	85	79	82	78	90	89	84	83	81	70	74	7
91	101	103	124	92	96	83	83	83	95	79	77	81	72	78	69	75	81	75	66	68	57	57	4
99	106	102	111	110	102	74	97	103	103	92	88	87	81	83	80	92	90	85	85	82	71	76	7
91	101	103	124	92	97	83	83	84	95	79	77	81	72	78	69	76	81	75	66	68	57	57	4
110	107	102	112	111	103	75	98	103	104	93	90	88	81	84	81	92	89	87	86	84	72	77	7
95	103	106	129	95	99	84	85	86	97	81	78	85	79	81	75	79	86	79	71	68	57	57	4
115	112	109	117	116	108	78	102	110	109	97	94	93	87	92	86	99	96	92	91	82	76	80	7
93	101	105	126	92	97	83	83	85	96	78	76	83	77	80	73	77	84	77	69	66	56	56	4
111	108	105	113	113	105	75	99	107	105	93	90	90	83	87	82	95	92	89	90	84	72	76	7
93	101	104	126	92	97	83	83	84	95	78	76	82	76	79	72	76	83	77	68	66	56	56	47
110	107	105	112	112	104	74	98	106	105	92	89	89	82	85	81	93	90	87	87	82	71	75	7
92	101	104	126	91	97	82	83	84	95	78	76	82	76	78	72	77	82	77	68	67	56	56	4
109	105	104	112	112	103	74	98	105	105	91	89	88	82	85	80	93	90	87	88	82	71	75	7
93	101	105	126	92	97	83	84	85	95	78	77	82	76	78	72	77	83	77	68	66	57	57	47
109	106	104	111	110	103	72	97	105	103	91	88	87	81	85	80	92	88	86	87	82	71	74	7
93	101	104	126	92	97	82	83	84	95	78	76	82	76	79	72	76	83	77	68	66	57	57	47
108	107	105	112	112	104	74	98	107	105	92	90	89	84	86	82	94	90	88	89	84	72	76	7
93	101	105	126	92	97	83	84	84	95	78	77	82	76	79	72	77	83	77	68	66	57	57	47
110	109	106	114	112	105	75	100	107	105	93	90	89	84	87	83	95	91	89	90	84	72	77	7

TA: LABORATORY BACK-TO-BACK TEST (SHEET 45)

IE (°C)

27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	TOTA
84 77	79 69	78 72	65 69	52 67	67 64	58 66	83 81	75 68	85 81	84 83	88 82	79 90	80 78	62 65	82 73	79 74	74 57	76 81	80 74	80 67	18	21.3 22.2
70 81	58 70	58 74	48 72	36 66	47 68	42 69	76 86	63 70	76 87	69 90	83 88	74 94	70 82	52 70	70 69	68 78	58 60	74 86	67 74	65 66	19	20.1 22.5
68 82	57 71	57 76	47 73	35 67	46 69	41 70	73 87	61 71	73 89	67 91	81 90	72 95	66 82	51 70	64 70	63 79	55 62	72 87	64 76	63 67	19	19.8 22.5
68 84	57 72	57 77	47 74	35 69	46 70	41 71	73 89	62 73	73 89	68 92	81 90	72 96	68 84	51 72	65 71	63 80	55 62	72 89	65 77	63 68	19	19.8 22.8
68 82	57 76	57 80	47 79	35 80	46 74	41 76	73 92	62 76	73 92	68 94	84 94	73 103	68 88	51 77	68 75	65 82	56 64	72 92	65 79	63 70	20	19.8 22.5
66 84	56 72	56 76	47 74	34 69	45 70	40 71	72 89	60 73	72 90	67 93	82 90	71 99	66 85	49 71	66 72	64 80	55 62	71 89	64 78	62 69	20	19.8 22.5
66 82	56 71	56 75	47 73	34 68	45 69	40 70	72 87	60 72	72 89	67 92	82 90	71 98	66 84	48 70	65 71	63 80	55 62	71 87	64 77	62 68	22	19.8 22.5
67 82	56 71	56 75	47 73	34 68	45 69	40 70	72 87	60 72	72 89	68 93	82 90	71 98	66 84	48 70	65 71	63 80	55 60	71 87	64 77	62 69	22	19.8 22.5
66 82	57 71	57 74	47 72	34 67	45 69	40 70	72 87	61 72	72 88	68 91	82 89	71 97	66 88	48 69	66 70	64 80	55 58	71 87	64 77	63 69	22	19.5 22.5
66 84	57 72	57 76	47 74	35 69	46 70	40 72	72 89	60 73	72 90	68 92	82 90	71 99	66 87	48 71	66 73	64 82	55 57	71 89	64 78	63 69	22	19.8 22.5
66 84	57 72	57 77	47 74	35 69	46 70	40 73	72 89	61 71	72 90	68 92	82 91	71 100	66 88	48 72	66 73	64 83	56 57	71 89	64 78	63 69	23	19.8 22.5

TEST (SHEET 45)

												PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
												FLOW							
37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
84	88	79	80	62	82	79	74	76	80	80	18	21.3		70	42	40	37	21	18
83	82	90	78	65	73	74	57	81	74	67		22.2	5.3	66	44	39	35		
69	83	74	70	52	70	68	58	74	67	65	19	20.1		70	42	39	36	21	18
90	88	94	82	70	69	78	60	86	74	66		22.5	5.4	66	42	37	35		
67	81	72	66	51	64	63	55	72	64	63	19	19.8		70	42	40	36	21	18
91	90	95	82	70	70	79	62	87	76	67		22.5	5.5	66	44	38	35		
68	81	72	68	51	65	63	55	72	65	63	19	19.8		70	42	40	36	21	18
92	90	96	84	72	71	80	62	89	77	68		22.8	5.5	66	44	38	35		
68	84	73	68	51	68	65	56	72	65	63	20	19.8		70	42	40	36	21	18
94	94	103	88	77	75	82	64	92	79	70		22.5	5.6	64	42	37	35		
67	82	71	66	49	66	64	55	71	64	62	20	19.8		70	42	40	36	21	18
93	90	99	85	71	72	80	62	89	78	69		22.5	5.5	65	43	38	35		
67	82	71	66	48	65	63	55	71	64	62	22	19.8		70	42	40	36	21	18
92	90	98	84	70	71	80	62	87	77	68		22.5	5.5	65	43	38	35		
68	82	71	66	48	65	63	55	71	64	62	22	19.8		70	42	40	36	21	18
93	90	98	84	70	71	80	60	87	77	69		22.5	5.5	65	43	37	35		
68	82	71	66	48	66	64	55	71	64	63	22	19.5		70	42	40	36	21	18
91	89	97	88	69	70	80	58	87	77	69		22.5	5.4	65	43	37	35		
68	82	71	66	48	66	64	55	71	64	63	22	19.8		70	42	40	36	21	18
92	90	99	87	71	73	82	57	89	78	69		22.5	5.5	65	43	37	35		
68	82	71	66	48	66	64	56	71	64	63	23	19.8		70	42	40	36	21	18
92	91	100	88	72	73	83	57	89	78	69		22.5	5.5	64	43	37	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9
1/16/73	13:35	212:26	1950	250	DUMMY TEST	74 102	113 76	98 119	116 123	92 117	113 117	97 114	105 111	108 108
1/16	14:05	212:56	1950	250	DUMMY TEST	74 102	114 76	98 119	117 123	93 116	113 116	97 114	105 110	109 108
1/16	14:35	213:26	1950	250	DUMMY TEST	74 100	112 75	97 116	115 121	90 112	110 113	95 110	102 107	106 105
1/16	15:05	213:56	2400	250	DUMMY TEST	74 101	112 75	97 117	115 121	91 114	111 114	95 105	103 107	106 106
1/16	15:35	214:26	2400	250	DUMMY TEST	74 100	112 75	97 117	115 121	91 114	111 114	95 109	102 108	107 106
1/16	16:05	214:56	2400	250	DUMMY TEST	75 101	112 75	97 117	115 122	91 113	110 114	95 110	102 109	107 106
1/16	16:35	215:26	2400	250	DUMMY TEST	75 101	112 74	97 117	115 122	91 113	110 114	95 110	102 109	107 106
						Stop - Check strainers on powe								
1/16	17:50	215:56	2400	250	DUMMY TEST	74 100	111 73	96 115	114 120	90 111	110 111	95 110	102 106	106 104
1/16	18:20	216:26	2700	250	DUMMY TEST	75 101	113 74	99 116	116 121	92 113	112 113	97 111	104 108	108 106
1/16	18:50	216:56	2700	250	DUMMY TEST	75 101	114 75	99 117	116 121	92 113	112 113	97 111	104 109	108 106
						Stop - Increase tail power								
1/16	19:30	217:26	3000	425	DUMMY TEST	79 100	111 73	98 116	115 120	90 112	111 111	95 110	103 106	107 104

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY BACK-

TEMPERATURE (°C)																							
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
129	97	101	86	87	88	99	83	80	86	80	82	77	81	88	81	72	70	60	60	48	37	50	40
116	115	107	78	101	110	108	96	93	92	86	90	86	98	95	92	91	87	76	80	79	73	75	77
130	97	101	87	88	89	100	83	81	87	81	83	78	82	88	82	74	71	61	61	48	38	50	41
116	115	107	77	101	109	107	95	92	92	86	89	85	98	95	91	90	86	76	80	78	72	74	75
127	94	98	85	86	86	96	80	78	85	79	81	75	78	86	79	70	68	58	58	47	36	48	40
112	111	103	74	98	106	104	92	89	89	82	86	82	93	90	89	88	84	73	76	74	69	70	72
128	94	98	85	86	86	96	80	78	85	81	81	78	80	88	80	73	68	58	58	47	36	48	40
113	112	105	74	99	109	105	92	90	90	85	88	84	95	92	90	89	83	72	76	74	70	70	72
28	94	99	84	86	86	96	80	78	85	81	82	78	81	88	80	73	68	58	58	47	36	48	40
13	112	105	74	99	109	105	92	90	90	85	88	84	96	91	91	90	84	73	77	75	69	71	72
28	93	98	85	86	86	97	80	78	85	81	81	77	80	87	79	73	67	57	58	47	35	48	40
14	113	105	74	99	109	105	92	90	90	85	88	84	96	91	90	89	83	72	76	74	69	70	72
28	94	98	85	86	86	97	80	78	85	81	81	77	80	87	79	73	67	58	58	48	35	47	41
13	112	104	74	99	109	105	92	80	90	85	88	83	96	93	90	89	84	72	76	74	69	70	72
at 17:00																							
27	93	98	84	85	86	96	80	77	84	79	81	76	80	86	79	73	68	57	57	47	36	48	40
12	111	102	72	97	107	103	90	88	87	82	84	81	93	89	87	85	80	75	72	71	67	68	69
29	96	100	86	87	88	98	82	80	87	83	84	81	84	90	82	77	69	59	58	47	36	49	41
13	112	104	73	98	109	104	92	90	90	86	88	84	96	92	90	89	82	71	74	72	68	69	70
29	96	100	86	87	88	98	82	80	87	83	84	81	84	90	82	77	69	59	58	47	36	48	41
14	112	104	73	98	109	104	92	91	90	86	88	84	96	92	90	89	82	71	74	72	69	69	70
n power at 19:00																							
29	95	99	84	86	87	98	81	79	86	81	83	79	82	88	80	76	69	61	61	48	37	50	44
11	110	102	71	97	108	103	90	87	87	85	86	82	95	92	88	88	82	72	75	74	71	72	72

TEST (SHEET 46)

37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
70	86	75	69	55	69	67	59	76	68	66	24	20.1		70	42	40	36	21	18
95	94	103	89	76	76	84	55	92	80	72		22.5	5.5	64	42	37	35		
70	87	76	70	56	70	68	60	76	68	67	23	19.8		70	42	40	36	21	18
95	93	102	89	75	75	84	55	91	86	71		22.5	5.5	64	42	37	35		
69	84	72	69	50	68	66	57	72	66	65	23	19.8		70	42	40	36	21	18
94	90	99	89	70	73	84	56	89	79	70		22.5	5.5	64	42	37	35		
69	85	72	68	50	67	65	57	72	65	64	23	19.8		70	42	40	36	21	18
93	90	100	86	71	70	81	58	88	78	69		22.5	5.5	64	42	37	35		
69	85	72	68	51	68	66	57	72	65	64	23	19.8		70	42	40	36	21	18
93	90	101	88	71	70	83	55	88	79	69		22.5	5.5	64	42	37	35		
68	85	72	68	50	67	65	57	72	66	64	23	19.8		70	41	40	36	21	18
93	90	100	85	71	70	81	55	88	78	69		22.5	5.5	64	42	37	35		
68	85	72	68	50	67	65	57	72	65	64	23	19.8		70	41	40	36	21	18
93	90	100	87	71	70	81	55	88	78	69		22.5	5.5	64	42	37	35		
68	85	73	67	51	67	65	56	73	64	64	23	19.8		70	42	40	36	21	18
89	87	97	84	69	70	81	57	85	76	67		22.5	5.4	65	43	38	35		
69	87	74	68	53	69	66	58	74	65	66	22	20.1		70	42	40	36	21	18
92	90	99	85	71	72	81	57	88	78	69		22.5	5.4	65	42	38	35		
69	87	74	68	53	69	66	58	74	65	66	22	20.1		70	42	40	36	21	18
92	90	99	85	71	72	81	57	88	78	69		22.5	5.4	65	42	38	35		
70	86	76	69	50	68	66	57	75	66	66	22	19.8		70	42	40	36	21	18
93	90	99	84	68	71	80	56	87	77	69		22.5	5.4	65	42	37	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
1/16	20:00	217:56	3000	425	DUMMY TEST	80 100	111 73	98 115	115 120	90 112	111 112	95 110	103 106	107 104	129 111
1/16	20:30	218:26	3000	425	DUMMY TEST	80 100	111 73	98 115	116 120	90 112	111 112	96 110	103 106	107 104	130 111
1/16	21:00	218:56	3000	425	DUMMY TEST	81 100	111 73	97 115	115 120	90 112	111 112	95 110	103 106	107 104	129 112
1/16	21:30	219:26	3000	425	DUMMY TEST	81 100	111 73	97 115	115 120	90 112	111 112	95 110	103 106	107 104	129 112
1/16	22:00	219:56	3000	425	DUMMY TEST	81 99	111 73	87 115	115 120	90 112	111 112	95 110	103 106	107 104	129 112
1/16	22:15	220:11	1950	425	DUMMY TEST	81 100	111 72	98 114	114 120	89 110	109 110	94 108	101 105	105 103	126 110
1/16	22:45	220:41	3000	425	DUMMY TEST	81 99	111 73	97 115	115 120	90 112	111 112	95 110	103 106	107 104	129 111
1/16	23:15	221:11	3000	425	DUMMY TEST	81 99	111 73	97 115	115 120	90 112	111 112	95 110	103 106	107 104	129 111
1/16	23:45	221:41	3000	425	DUMMY TEST	81 99	112 73	97 115	116 120	90 112	111 112	96 110	103 106	107 104	129 111
1/17	00:15	222:11	3000	425	DUMMY TEST	82 99	112 73	98 115	116 120	90 112	111 112	96 110	103 106	107 104	129 112
1/17	00:45	222:41	3000	425	DUMMY TEST	81 99	111 73	97 115	116 120	90 112	111 112	95 110	103 106	107 104	129 111

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATORY

TEMPERATURE (°C)

8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
103	107	129	94	99	84	86	87	98	80	79	86	82	83	80	82	88	80	76	69	61	61	48	37
106	104	111	110	103	81	97	108	103	90	88	87	84	86	82	95	93	89	88	82	72	77	74	71
103	107	130	94	99	85	86	87	98	81	79	86	82	83	80	83	89	81	76	70	61	61	48	37
106	104	111	110	103	71	97	108	103	90	88	87	85	86	82	95	93	89	87	81	71	77	74	70
103	107	129	95	99	85	86	87	98	81	79	86	82	83	80	83	89	81	76	69	61	61	48	37
106	104	112	110	103	71	97	108	103	90	87	88	84	86	82	95	93	89	88	82	72	77	74	71
103	107	129	95	99	85	86	87	98	81	79	86	82	83	80	83	89	81	76	69	61	61	48	37
106	104	112	110	103	71	97	108	103	90	87	88	84	86	82	95	93	89	88	82	72	77	74	71
103	107	129	94	99	84	86	87	98	81	79	86	83	83	80	83	89	80	76	69	61	61	48	37
106	104	112	110	103	71	97	108	103	90	87	87	85	86	82	95	93	89	88	82	72	77	74	70
101	105	126	92	97	83	85	84	96	80	79	83	78	80	74	79	85							
105	103	110	109	101	70	96	105	103	90	87	87	81	85	80	91	90							
103	107	129	94	99	84	95	97	98	80	79	86	83	83	80	82	88	80	76	69	60	61	48	37
106	104	111	110	103	70	97	108	103	90	87	87	84	86	82	94	92	88	87	71	71	77	74	69
103	107	129	94	99	84	85	87	98	80	79	86	83	83	80	82	88	80	76	69	60	61	48	37
106	104	111	110	103	70	97	108	103	90	87	87	84	86	82	94	92	88	87	81	71	77	74	66
103	107	129	95	99	84	86	87	98	81	79	86	83	83	80	83	89	80	76	69	60	61	48	37
106	104	111	110	103	71	97	108	103	90	87	87	84	86	82	95	84	88	87	81	71	77	74	70
103	107	129	94	99	85	86	87	98	81	79	86	83	83	80	83	89	80	76	69	63	61	48	37
106	104	112	110	103	71	97	108	103	90	87	87	83	86	82	95	84	89	87	81	71	77	74	70
103	107	129	95	99	84	85	87	98	81	79	86	83	83	80	83	88	80	76	69	62	60	48	37
106	104	111	110	103	71	97	108	104	90	87	87	84	87	82	95	85	89	87	81	71	77	74	70

...CK TEST (SHEET 47)

													PUMP			MANIFOLD			DUMMY INPUT PRESS	
													FLOW			PRESS				
36	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
77	69	86	76	69	50	68	66	57	75	66	66	22	19.8		70	42	40	36	21	18
91	94	90	99	85	68	72	81	60	87	77	69		22.5	5.4	65	43	37	35		
77	70	86	76	69	50	69	66	57	75	66	66	22	19.8		70	42	40	36	21	18
90	93	90	99	84	68	70	79	60	87	77	68		22.5	5.4	65	43	37	35		
77	69	86	76	69	50	68	66	57	75	66	67	22	19.8		70	42	40	36	21	18
91	94	90	99	84	68	72	80	59	87	77	68		22.5	5.4	65	43	37	35		
77	69	86	76	69	50	68	66	57	75	66	67	22	19.8		70	42	40	36	21	18
91	94	90	99	84	68	72	80	59	87	77	68		22.5	5.4	65	43	37	35		
76	69	86	76	69	50	68	66	57	75	66	66	22	19.8		70	42	40	36	21	18
90	93	90	99	84	68	71	79	59	87	77	68		22.5	5.4	65	43	37	35		
													19.8		70	42	40	36	21	18
													22.2	5.3	65	43	37	35		
76	69	86	76	69	50	68	6[illegible]	57	75	66	66	22	19.8		70	42	40	36	21	18
90	93	90	98	82	68	70	79	59	86	77	68		22.2	5.3	65	43	37	35		
76	69	86	76	69	50	68	66	57	75	66	66	22	19.8		70	42	40	36	21	18
90	93	90	98	82	68	70	79	59	87	77	68		22.5	5.4	65	43	37	35		
76	69	86	76	70	50	68	66	57	75	66	66	21	19.8		70	42	40	36	21	18
90	93	90	99	84	68	71	81	62	87	77	68		22.5	5.4	65	43	37	35		
76	69	86	76	69	50	68	65	57	75	66	66	21	19.8		70	42	39	36	21	18
90	93	90	99	82	68	71	80	61	87	77	68		22.5	5.3	64	42	37	35		
76	69	86	76	70	50	67	65	57	75	65	66	21	19.8		70	42	39	36	21	18
90	93	90	99	82	68	71	80	59	86	77	68		22.5	5.3	64	42	37	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9
1/17/73	01:15	223:11	3000	425	DUMMY TEST	81 99	111 72	98 115	116 120	90 112	111 112	95 110	103 106	107 104
1/17	01:45	223:41	3000	425	DUMMY TEST	82 99	112 72	98 115	116 120	90 112	111 112	96 110	103 106	107 104
1/17	06:00	223:56	1950	425	DUMMY TEST	85 97	110 72	100 113	115 118	89 109	110 108	94 107	101 103	106 100
1/17	06:30	224:26	3560	425	DUMMY TEST	83 99	112 78	96 118	115 121	91 116	113 115	96 114	105 110	108 108
1/17	06:45	224:41	1950	425	DUMMY TEST	82 97	111 75	97 115	114 121	88 112	109 112	93 111	101 108	105 105
1/17	07:15	225:11	3560	425	DUMMY TEST	82 100	113 77	95 120	117 123	92 118	114 117	97 117	106 112	109 110
1/17	07:30	225:26	1950	425	DUMMY TEST	82 100	111 77	97 119	115 121	90 116	111 116	95 114	103 110	107 109
1/17	08:00	225:56	3560	425	DUMMY TEST	84 102	113 80	97 121	117 124	93 120	115 120	99 119	107 114	110 112
1/17	08:15	226:11	1950	425	DUMMY TEST	84 99	113 77	99 116	116 121	90 113	111 114	96 111	103 107	107 105
1/17	08:30	226:26	3700	425	DUMMY TEST	84 100	113 78	97 117	117 121	193 115	115 116	99 114	107 109	110 108
1/17	08:45	226:41	1950	425	DUMMY TEST	85 99	113 76	99 115	116 121	91 112	112 112	97 110	104 106	108 104

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABORATO

TEMPERATURE (°C)																							
7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
95	103	107	129	95	99	84	85	87	99	80	79	86	83	85	80	82	88	80	76	69	62	61	48
10	106	104	111	110	102	70	97	108	103	90	87	87	84	86	82	95	85	89	87	81	71	77	74
96	103	107	129	95	99	84	85	87	99	81	79	86	83	85	79	83	89	80	76	69	62	61	48
10	106	104	112	111	103	71	97	108	103	90	87	87	84	86	82	95	85	89	87	82	71	77	74
94	101	106	126	93	98	84	90	86	99	82	81	84	76	80	74	78	83	80	71	73	73	72	59
07	103	100	108	108	100	70	95	102	101	87	84	83	76	77	76	86	78	76	77	71	60	64	62
96	105	108	131	96	101	86	86	89	102	82	80	89	88	86	85	88	91	85	83	72	63	62	49
14	110	108	115	114	105	75	100	112	107	93	90	93	90	95	89	102	90	94	94	84	77	81	79
93	101	105	126	93	97	84	84	85	98	81	79	83	77	81	75	80	86						
11	108	105	112	112	103	73	97	106	105	91	89	90	83	87	82	92	89						
97	106	109	132	97	102	86	86	90	102	82	81	90	91	91	87	90	93	86	83	72	63	61	48
17	112	110	117	116	109	77	102	115	109	95	93	95	94	97	91	103	95	95	97	86	78	83	81
95	103	107	128	95	99	85	85	86	100	82	80	86	81	83	78	82	88						
14	110	109	116	115	107	76	101	110	108	95	92	94	87	91	87	97	95						
99	107	110	133	98	103	88	88	92	102	84	82	91	93	91	88	92	94	87	87	75	64	62	49
19	114	112	119	118	110	80	104	117	111	97	95	98	95	99	93	105	95	99	100	89	81	85	84
96	103	107	128	95	99	86	86	87	101	82	81	86	81	83	78	82	87						
11	107	105	113	112	104	73	98	108	105	92	90	91	84	88	83	95	89						
99	107	110	133	98	103	87	88	92	103	84	82	91	94	92	88	92	95						
14	109	108	114	114	106	74	100	112	107	92	90	93	93	95	89	101	96						
97	104	108	129	96	100	86	87	88	103	83	82	88	83	85	80	84	89						
10	106	104	112	111	103	72	97	107	105	90	89	90	83	87	82	92	84						

...CK TEST (SHEET 48)

													PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
													FLOW							
36	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
76	69	86	76	69	49	68	65	57	75	65	66	21	19.8		70	42	39	36	21	18
90	93	90	99	84	68	71	80	60	87	77	68		22.2	5.3	64	42	37	35		
76	69	86	76	69	49	68	65	57	75	65	66	21	19.8		70	42	39	36	21	18
90	93	90	99	84	68	71	80	60	87	77	68		22.2	5.3	64	42	37	35		
82	78	86	80	78	51	77	73	65	80	73	73	23	19.8		70	42	40	36	21	18
78	77	78	85	76	59	60	71	60	77	67	58		22.5	5.4	66	44	38	35		
78	70	89	77	69	52	69	66	58	77	67	67	20	20.4		71	42	40	36	21	18
90	92	90	103	82	72	74	80	58	89	78	68		22.8	5.5	66	43	38	35		
													19.6		70	42	40	36	21	18
													20.8	5.5	64	43	38	35		
78	68	90	77	68	54	68	66	58	77	66	68	17	20.4		70	42	40	36	21	18
91	92	92	105	83	72	71	80	62	90	78	68		22.8	5.5	65	42	37	35		
													19.8		70	42	40	36	21	18
													22.8	5.5	65	43	37	35		
79	70	91	79	71	55	69	68	60	78	68	68	20	20.4		70	42	40	37	21	18
94	94	94	107	85	77	76	82	62	93	81	71		22.8	5.6	64	42	37	35		
													20.1		70	42	40	36	21	18
													22.8	5.5	66	43	37	35		
													20.4		70	42	40	36	21	18
													22.8	5.5	65	42	37	35		
													20.1		70	42	40	36	21	18
													22.8	5.4	66	43	37	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
1/17/73	09:00	226:56	3700	425	DUMMY TEST	85 99	113 78	97 117	117 121	93 115	115 114	98 114	106 109	110 107	133 114
						Stop for inspection of chip detectors an									
1/17	10:05	226:56	1100	250	DUMMY TEST	86 96	111 76	102 111	113 117	88 106	108 105	92 95	100 100	103 97	122 107
1/17	10:35	227:26	1100	250	DUMMY TEST	83 97	110 75	98 111	112 117	88 106	107 106	91 94	99 101	102 99	123 107
1/17	11:05	227:56	1100	250	DUMMY TEST	83 100	110 78	97 117	112 122	87 113	106 114	91 100	98 107	102 105	122 113
1/17	11:35	228:26	1100	250	DUMMY TEST	84 100	110 79	98 119	112 124	87 115	106 117	90 114	98 110	102 107	122 116
1/17	12:05	228:56	1950	250	DUMMY TEST	84 101	111 79	97 117	114 122	90 114	109 115	94 112	101 108	105 106	127 115
1/17	12:35	229:26	1950	250	DUMMY TEST	85 101	112 79	97 117	115 122	90 114	110 115	95 113	102 109	105 107	127 114
1/17	13:05	229:56	1950	250	DUMMY TEST	87 102	115 80	101 118	118 123	94 115	114 116	98 114	106 109	110 107	131 115
1/17	13:35	230:26	1950	250	DUMMY	87 102	115 80	101 118	118 123	94 115	114 116	99 114	106 110	110 108	131 115
1/17	14:05	230:56	1950	250	DUMMY TEST	85 102	112 80	99 117	115 122	91 114	110 115	95 113	103 109	106 107	128 115
1/17	14:35	231:26	1950	250	DUMMY TEST	85 102	112 80	98 117	115 122	91 114	110 115	95 113	102 108	106 107	128 115

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:L

TEMPERATURE (°C)

5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	2
93	115	98	106	110	133	98	102	87	88	92	104	83	82	90	92	91	87	91	93				
115	114	114	109	107	114	113	105	74	99	112	106	92	90	92	91	94	88	100	89				
ction of chip detectors and strainers							Change tail load																
88	108	92	100	103	122	92	96	82	86	83	95	81	81	82	76	79	75	79	81	78	72	73	7
106	105	95	100	97	107	105	98	67	92	99	99	85	83	80	74	77	74	85	76	79	79	77	7
88	107	91	99	102	123	90	96	83	83	82	93	77	76	80	71	73	69	73	79	75	64	67	5
106	106	94	101	99	107	106	98	69	92	100	99	86	83	82	74	77	75	86	79	80	79	78	6
87	106	91	98	102	122	89	95	81	82	82	94	76	75	79	69	70	66	73	77	73	63	66	5
113	114	100	107	105	113	112	105	76	99	107	105	93	90	90	82	85	83	92	85	85	85	84	7
87	106	90	98	102	122	90	95	81	82	82	94	76	75	79	70	71	67	73	87	73	63	66	5
115	117	114	110	107	116	115	107	78	101	109	108	95	93	92	85	89	85	96	90	90	90	87	7
90	109	94	101	105	127	92	97	83	84	85	96	78	77	83	76	78	73	77	84	78	69	67	6
114	115	112	108	106	115	113	105	75	100	109	106	93	90	91	85	87	84	95	86	90	90	89	8
90	110	95	102	105	127	93	98	83	85	86	97	79	78	83	77	79	74	78	85	78	70	68	61
114	115	113	109	107	114	113	105	75	100	110	105	93	90	91	85	88	84	95	87	90	90	84	75
94	114	98	106	110	131	99	102	88	88	89	101	84	82	88	82	83	78	83	90	83	76	72	64
115	116	114	109	107	115	114	106	76	100	110	106	93	91	92	92	89	85	96	87	91	90	85	76
94	114	99	106	110	131	99	103	89	88	90	101	84	83	88	83	84	80	83	91	83	77	73	65
115	116	114	110	108	115	114	106	76	101	110	107	94	92	92	85	89	85	96	89	91	91	85	76
91	110	95	103	106	128	94	99	85	86	86	97	79	78	84	78	80	75	79	86	79	71	68	61
114	115	113	109	107	115	113	106	76	100	110	106	93	91	91	85	88	85	95	92	91	89	79	76
91	110	95	102	106	128	94	98	84	85	86	97	80	78	84	78	79	75	79	86	79	71	68	61
114	115	113	108	107	115	113	105	75	100	110	106	93	90	91	85	88	84	95	87	90	89	84	75

LABORATORY BACK-TO-BACK TEST (SHEET 49)

																					PU	
																					FLOW	
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROL
																					20.1	
																					22.8	5.
71	70	57	44	59	48	79	68	80	75	83	78	76	51	75	72	63	78	73	72	25	19.8	
72	79	74	69	69	70	81	68	82	84	82	90	78	64	72	74	47	81	72	66		22.2	5.
59	58	48	36	47	43	73	61	73	69	80	72	68	48	65	64	55	72	64	64	23	19.2	
69	73	71	68	69	69	82	68	84	89	84	92	79	65	68	77	49	82	72	65		22.5	5.
59	57	47	35	46	41	72	60	72	68	79	71	67	47	64	62	54	71	63	63	23	19.2	
75	79	90	73	74	76	89	74	90	93	90	98	84	73	74	81	50	89	77	69		22.8	5.5
59	58	48	36	47	43	72	60	72	68	79	71	67	47	63	62	54	71	63	63	23	19.2	
78	82	81	76	77	79	92	77	93	95	93	101	87	76	78	84	51	92	79	71		23.1	5.5
60	58	48	36	47	43	73	61	73	69	83	72	68	49	65	63	55	72	65	65	24	19.5	
84	75	78	73	74	76	83	74	91	94	90	100	85	71	76	82	45	89	77	70		22.8	5.4
61	59	50	38	49	45	73	62	73	69	83	73	68	49	66	64	56	72	65	65	25	20.1	
75	79	77	73	74	76	89	74	90	93	90	101	84	72	73	82	46	89	78	69		22.8	5.5
64	63	53	41	52	48	78	66	78	72	88	78	72	56	70	68	60	77	68	69	25	20.4	
76	80	79	74	76	77	89	74	91	94	90	102	85	73	72	82	41	89	79	70		22.8	5.5
65	63	53	41	52	48	78	66	78	72	89	78	72	57	72	70	61	78	69	69	25	20.1	
76	79	78	74	76	77	90	75	91	94	91	102	85	74	76	82	41	90	79	70		22.8	5.5
61	60	50	34	45	41	74	63	74	70	84	73	69	50	68	65	57	73	66	65	26	19.5	
76	79	78	74	76	76	89	74	91	94	90	101	85	72	73	82	43	89	79	70		23.1	5.5
61	60	50	34	45	41	74	63	74	70	84	73	70	50	67	65	57	73	66	65	26	19.5	
75	79	78	73	74	76	89	74	90	94	90	102	86	72	73	82	43	89	79	70		22.8	5.5

SHEET 49)

39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
										20.1		70	42	40	37	21	18
										22.8	5.5	65	43	37	35		
78	76	51	75	72	63	78	73	72	25	19.8		70	42	39	36	21	18
90	78	64	72	74	47	81	72	66		22.2	5.2	65	44	37	35		
72	68	48	65	64	55	72	64	64	23	19.2		70	42	39	35	21	17
92	79	65	68	77	49	82	72	65		22.5	5.3	66	44	37	35		
71	67	47	64	62	54	71	63	63	23	19.2		70	42	39	35	21	17
98	84	73	74	81	50	89	77	69		22.8	5.5	65	43	37	35		
71	67	47	63	62	54	71	63	63	23	19.2		69	41	39	35	21	17
101	87	76	78	84	51	92	79	71		23.1	5.5		42	37	35		
72	68	49	65	63	55	72	65	65	24	19.5		70	41	39	35	20	18
100	85	71	76	82	45	89	77	70		22.8	5.4	65	42	38	34		
73	68	49	66	64	56	72	65	65	25	20.1		70	41	39	36	21	18
101	84	72	73	82	46	89	78	69		22.8	5.5	65	42	37	35		
78	72	56	70	68	60	77	68	69	25	20.4		70	41	40	36	21	18
102	85	73	72	82	41	89	79	70		22.8	5.5	65	42	37	35		
78	72	57	72	70	61	78	69	69	25	20.1		70	41	40	36	21	18
102	85	74	76	82	41	90	79	70		22.8	5.5	65	42	37	35		
73	69	50	68	65	57	73	66	65	26	19.5		70	41	39	36	21	18
101	85	72	73	82	43	89	79	70		23.1	5.5	65	42	37	35		
73	70	50	67	65	57	73	66	65	26	19.5		69	41	39	36	21	18
102	86	72	73	82	43	89	79	70		22.8	5.5	65	42	37	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
1/17/73	15:05	231:56	2400	250	DUMMY TEST	86	113	100	117	93	113	97	105	108	131
						103	82	119	124	118	118	116	112	110	117
1/17	15:35	232:26	2400	250	DUMMY TEST	86	113	100	117	93	113	97	105	108	131
						104	82	120	124	117	118	116	111	110	117
1/17	16:05	232:56	2400	250	DUMMY TEST	87	113	100	117	93	113	97	105	109	131
						104	82	120	124	117	118	116	112	110	118
1/17	16:35	233:26	2400	250	DUMMY TEST	87	113	99	117	93	113	97	105	108	131
						103	82	120	124	117	118	116	111	110	117
						Stop on power at 19:30									
1/17	20:00	233:56	2400	250	DUMMY TEST	84	111	99	115	91	111	95	103	107	128
						98	74	113	118	109	109	107	103	101	111
1/17	20:30	234:26	2700	250	DUMMY TEST	85	112	99	111	92	112	97	104	108	130
						98	73	113	118	109	109	108	103	102	110
1/17	21:00	234:56	2700	250	DUMMY TEST	85	113	100	117	93	113	97	105	109	131
						98	74	114	119	110	110	109	104	103	112
1/17	21:30	235:26	1950	250	DUMMY TEST	85	113	100	116	92	111	96	103	107	129
						98	74	114	120	111	111	109	105	103	112
1/17	22:00	235:56	1950	250	DUMMY TEST	85	113	100	116	92	111	96	103	107	129
						99	74	115	170	111	111	110	106	103	113
						Stop on power at 01:05									
1/18	01:35	236:26	1950	250	DUMMY TEST	83	110	95	113	87	108	93	100	104	125
						95	70	114	119	110	110	109	105	102	111
1/18	02:05	236:56	1950	250	DUMMY TEST	80	110	95	113	88	108	93	100	104	126
						97	70	115	120	112	113	111	107	105	114
						Shut down end of cycle and end of shift									

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LA

TEMPERATURE (°C)

5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
93	113	97	105	108	131	97	101	86	88	89	99	82	80	87	85	85	82	86	90	83	79	69	62
.18	118	116	112	110	117	116	109	78	102	113	108	95	93	95	90	92	89	100	91	93	94	85	77
93	113	97	105	108	131	96	101	87	88	89	99	82	80	88	85	85	82	86	90	83	80	69	62
.17	118	116	111	110	117	116	108	78	103	113	109	95	93	95	90	93	89	101	91	94	94	86	77
93	113	97	105	109	131	97	101	87	88	89	99	82	80	88	85	85	82	86	91	83	80	69	63
.17	118	116	112	110	118	116	109	78	103	114	109	96	93	95	90	93	90	101	94	93	94	86	77
93	113	97	105	108	131	97	101	87	88	89	99	82	80	88	85	85	82	86	91	83	80	69	62
17	118	116	111	110	117	116	109	78	103	114	109	95	93	95	90	93	89	101	94	94	94	86	77
on power at 19:30																							
91	111	95	103	107	128	94	99	84	86	87	97	80	79	85	82	85	78	81	88	81	76	69	61
09	109	107	103	101	111	109	100	69	95	105	101	87	84	86	80	83	80	90	80	84	84	78	74
92	112	97	104	108	130	97	100	85	87	88	98	82	80	87	83	86	80	83	89	81	76	70	62
09	109	108	103	102	110	109	100	70	95	105	101	87	84	86	79	83	80	90	81	83	82	78	71
93	113	97	105	109	131	98	101	87	87	89	99	83	81	88	86	87	82	85	89	83	79	71	62
10	110	109	104	103	112	110	101	70	96	107	102	88	86	88	82	85	81	92	83	86	86	79	70
92	111	96	103	107	129	95	99	85	86	87	98	81	79	85	80	82	76	81	87	80	72	69	61
11	111	109	105	103	112	111	102	72	96	106	103	90	87	87	80	84	81	90	82	86	85	80	71
92	111	96	103	107	129	95	99	85	86	87	98	81	79	85	80	82	76	81	87	80	71	70	61
11	111	110	106	103	113	112	102	72	97	107	103	90	87	87	81	85	81	91	83	87	85	80	71
power at 01:05																							
7	108	93	100	104	125	90	96	81	82	84	95	76	75	81	75	76	71	76	82	77	68	66	57
.0	110	109	105	102	111	110	100	71	95	105	101	88	85	85	79	82	79	89	85	82	80	79	68
8	108	93	100	104	126	92	96	81	82	84	96	77	76	82	75	76	72	76	83	77	69	67	57
.2	113	111	107	105	114	113	103	73	97	108	104	91	88	89	82	86	83	92	90	88	86	81	71

cycle and end of shift

A:LABORATORY BACK-TO-BACK TEST (SHEET 50)

°C)

27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	FLO TOTAL R
69	62	61	48	38	50	41	75	64	75	70	88	75	71	52	68	66	58	74	67	67	27	20.1
85	77	81	79	69	70	72	84	70	92	94	92	105	87	74	75	84	43	90	79	71		22.8
69	62	61	48	38	50	41	75	64	76	71	88	75	71	52	69	67	59	75	67	67	29	20.1
86	77	81	79	75	77	78	91	77	92	94	92	105	87	74	76	84	43	91	79	72		22.8
69	63	62	49	38	51	42	75	64	76	71	88	75	71	52	69	67	59	75	67	67	27	20.1
86	77	80	79	75	77	78	91	77	92	94	92	105	88	74	76	84	43	91	79	72		22.8
69	62	61	48	38	50	41	75	64	76	71	88	75	71	52	69	66	59	75	67	66	26	20.1
86	77	81	79	75	77	78	91	77	93	95	92	105	87	74	75	84	43	91	80	71		22.8
69	61	60	47	36	48	40	75	63	75	69	96	75	69	52	68	66	57	74	67	66	24	20.4
78	74	72	71	67	68	69	82	68	84	89	84	95	81	66	68	78	41	82	74	66		22.5
70	62	61	48	38	50	41	75	63	76	70	87	75	70	53	67	65	58	75	67	66	24	20.4
78	71	72	71	67	68	70	82	69	85	90	84	95	82	65	69	79	41	82	74	68		22.5
71	62	61	48	38	50	41	76	64	76	70	88	76	71	54	68	66	58	75	68	67	24	20.4
79	70	73	71	68	68	70	83	69	85	90	84	96	82	66	69	79	41	83	74	67		22.5
69	61	60	47	36	48	40	75	63	76	70	85	75	70	52	69	66	58	74	67	66	24	20.1
80	71	75	74	69	70	72	85	70	87	91	86	96	82	68	69	79	41	85	75	68		22.5
70	61	60	47	36	48	40	75	63	75	70	85	75	69	52	68	66	58	74	66	66	24	20.1
80	71	76	74	69	70	72	85	71	87	91	87	96	84	69	70	80	42	85	76	68		22.5
66	57	55	46	34	45	40	72	59	72	66	82	72	65	48	64	62	53	71	63	62	17	19.5
79	68	71	70	66	68	69	82	67	84	88	83	94	77	67	66	74	40	82	71	63		22.5
67	57	56	46	35	46	40	72	59	72	65	82	72	64	48	64	61	53	71	63	62	17	19.8
81	71	76	74	69	69	72	86	70	87	90	87	98	80	70	69	77	41	85	74	66		22.8

TEST (SHEET 50)

												PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
												FLOW							
37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
70	88	75	71	52	68	66	58	74	67	67	27	20.1		70	41	40	36	21	17
94	92	105	87	74	75	84	43	90	79	71		22.8	5.5	65	42	37	35		
71	88	75	71	52	69	67	59	75	67	67	29	20.1		70	41	40	36	21	17
94	92	105	87	74	76	84	43	91	79	72		22.8	5.5	65	42	37	35		
71	88	75	71	52	69	67	59	75	67	67	27	20.1		70	41	40	36	21	18
94	92	105	88	74	76	84	43	91	79	72		22.8	5.5	65	42	37	35		
71	88	75	71	52	69	66	59	75	67	66	26	20.1		69	41	40	36	21	18
95	92	105	87	74	75	84	43	91	80	71		22.8	5.5	65	42	37	35		
69	96	75	69	52	68	66	57	74	67	66	24	20.4		70	42	40	36	21	18
89	84	95	81	66	68	78	41	82	74	66		22.5	5.5	66	44	38	36		
70	87	75	70	53	67	65	58	75	67	66	24	20.4		70	42	40	36	21	18
90	84	95	82	65	69	79	41	82	74	68		22.5	5.4	66	44	38	36		
70	88	76	71	54	68	66	58	75	68	67	24	20.4		70	42	40	36	21	18
90	84	96	82	66	69	79	41	83	74	67		22.5	5.3	66	44	38	36		
70	85	75	70	52	69	66	58	74	67	66	24	20.1		70	42	40	36	21	18
91	86	96	82	68	69	79	41	85	75	68		22.5	5.4	66	44	38	36		
70	85	75	69	52	68	66	58	74	66	66	24	20.1		70	42	40	36	21	18
91	87	96	84	69	70	80	42	85	76	68		22.5	5.4	66	44	38	36		
66	82	72	65	48	64	62	53	71	63	62	17	19.5		70	41	39	36	21	18
88	83	94	77	67	66	74	40	82	71	63		22.5	5.4	66	43	38	36		
65	82	72	64	48	64	61	53	71	63	62	17	19.8		70	41	39	36	21	18
90	87	98	80	70	69	77	41	85	74	66		22.8	5.5	66	43	38	36		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10
1/18/73	06:15	236:56	1100	250	DUMMY TEST	89 102	111 80	106 112	112 119	88 108	108 107	92 104	100 102	103 99	123 110
1/18	06:45	237:26	1100	250	DUMMY TEST	92 99	112 73	106 114	114 119	90 109	108 110	92 107	101 105	104 101	125 111
1/18	07:15	237:56	1100	250	DUMMY TEST	82 97	110 71	97 116	112 121	86 112	107 114	91 111	99 107	103 104	122 114
1/18	07:45	238:26	1100	250	DUMMY TEST	81 98	110 71	97 117	112 122	86 114	106 116	91 113	99 110	102 106	122 115
1/18	08:15	238:56	1950	250	DUMMY TEST	81 97	111 69	96 115	114 120	89 112	110 113	94 110	102 107	106 104	128 113
1/18	08:45	239:26	1950	250	DUMMY TEST	82 97	112 70	97 116	115 121	89 112	111 113	95 112	102 108	106 105	128 114
1/18	09:15	239:56	1950	250	DUMMY TEST	82 98	112 70	97 116	115 121	90 113	111 114	95 113	103 108	107 105	128 115
1/18	09:45	240:26	1950	250	DUMMY TEST	82 98	112 71	97 117	115 122	89 114	110 115	95 113	102 108	106 106	128 115
1/18	10:15	240:56	1950	250	DUMMY TEST	83 99	112 73	98 117	115 122	90 114	111 115	95 112	103 109	106 107	129 115
1/18	10:15	241:26	1950	250	DUMMY TEST	84 100	113 73	99 117	116 122	91 114	111 115	96 114	103 109	107 107	129 116
1/18	11:15	241:56	1950	250	DUMMY TEST	85 100	113 74	100 117	116 123	91 115	111 115	96 114	103 110	107 108	129 116

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABOR

TEMPERATURE (°C)

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
.08	92	100	103	123	91	96	82	88	82	95	79	78	82	73	77	72	76	80	77	68	73	76	74
.07	104	102	99	110	109	100	71	95	100	100	87	84	83	75	78	75	87	77	80	78	78	73	76
.08	92	101	104	125	92	97	85	88	83	96	80	78	82	72	75	69	75	81	78	66	70	63	61
.10	107	105	101	111	110	100	70	96	102	101	88	86	85	78	81	78	89	80	81	80	80	72	76
.07	91	99	103	122	90	95	82	82	83	96	78	76	80	71	76	68	73	79	74	64	65	57	55
.14	111	107	104	114	113	103	74	97	106	105	92	89	88	82	85	82	92	90	85	85	82	74	78
.06	91	99	102	122	90	95	81	81	82	96	77	75	80	71	75	68	73	79	73	63	65	56	54
.16	113	110	106	115	115	105	77	100	107	106	93	91	91	84	87	84	94	93	89	89	85	77	80
10	94	102	106	128	93	98	83	83	86	97	80	77	84	79	80	75	78	85	79	71	67	57	55
13	110	107	104	113	112	103	72	97	108	104	91	88	89	83	85	83	92	90	88	86	81	72	76
11	95	102	106	128	93	98	84	84	86	97	80	78	85	80	80	76	79	87	79	71	68	58	57
13	112	108	105	114	113	103	73	98	108	104	92	89	89	84	87	83	93	89	89	87	82	73	78
11	95	103	107	128	95	99	85	85	86	98	81	79	85	80	81	76	80	87	80	72	68	59	57
14	113	108	105	115	114	104	75	99	110	105	92	89	90	84	88	84	93	92	90	89	83	74	79
10	95	102	106	128	93	98	84	84	86	97	80	78	85	80	80	76	79	86	79	71	68	59	57
15	113	108	106	115	114	104	75	99	110	105	92	89	90	84	88	84	95	89	90	89	83	75	78
11	95	103	106	129	95	98	84	85	86	97	80	78	85	80	80	76	79	86	79	71	68	60	58
15	112	109	107	115	115	105	75	100	110	106	94	90	91	85	88	85	95	87	90	90	84	75	79
11	96	103	107	129	95	99	86	86	87	98	81	79	85	81	81	77	80	87	80	72	68	61	58
15	114	109	107	116	115	106	76	100	110	107	94	90	91	85	89	85	96	88	91	90	84	74	80
11	96	103	107	129	95	99	86	86	87	99	81	79	86	81	82	77	80	87	80	72	69	61	60
15	114	110	108	116	115	107	77	101	110	107	94	91	92	86	89	86	96	88	92	90	85	74	80

BACK TEST (SHEET 51)

														PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
														FLOW							
35	36	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
70	80	82	83	77	78	51	78	76	70	77	77	76	39	19.8		70	42	40	36	21	18
71	84	89	84	93	82	66	78	79	41	83	77	74		22.5	5.3	66	44	38	35		
54	77	74	82	75	73	49	73	70	61	75	69	69	22	19.5		70	42	40	36	21	18
72	87	92	85	94	84	68	74	80	42	85	76	67		22.5	5.4	66	44	38	35		
59	72	66	80	72	66	48	66	63	54	71	63	72	17	19.5		70	42	40	36	21	18
71	89	91	88	96	82	71	70	79	41	87	76	67		20.8	5.5	66	43	38	35		
59	72	65	79	71	64	47	63	60	52	71	62	52	15	19.5		70	42	40	36	21	18
73	91	93	91	99	85	74	71	81	66	90	77	69		20.8	5.6	66	43	38	35		
60	73	65	83	72	65	50	65	63	54	72	64	62	15	19.8		70	42	40	36	21	18
70	88	91	87	98	82	70	69	79	63	85	74	66		22.5	5.5	66	43	38	35		
61	73	66	84	73	66	51	66	64	55	73	65	63	15	20.1		70	42	40	36	21	18
71	89	91	88	99	81	70	69	78	68	86	76	66		22.8	5.5	65	43	38	35		
[illegible]	74	66	85	73	67	52	67	64	55	73	65	63	15	20.1		70	42	40	36	21	18
[illegible]	89	92	89	99	81	71	69	78	68	87	76	67		22.8	5.5	65	43	38	35		
1	74	66	84	73	67	51	67	64	55	73	65	63	16	20.1		70	42	40	36	21	18
2	90	92	89	100	82	72	70	79	65	87	77	68		22.8	5.5	65	43	38	35		
2	74	67	84	73	67	51	67	65	56	73	66	64	20	20.1		70	42	40	36	21	18
3	90	93	90	100	84	72	71	79	63	88	77	75		22.8	5.5	65	43	38	35		
2	75	68	85	74	68	53	68	66	57	74	66	65	21	20.1		70	42	40	36	21	18
1	90	92	90	101	81	73	72	79	77	89	79	73		22.8	5.5	65	43	38	35		
3	76	69	85	74	69	53	69	67	58	75	67	66	23	20.1		70	42	40	36	21	18
2	90	93	90	102	81	74	72	79	73	89	80	74		22.8	5.5	65	42	37	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	1
1/18/73	12:10	241:56	1950	250	DUMMY TEST	88 99	113 74	101 115	116 120	92 111	112 110	96 109	103 105	107 102	12 11
1/18	12:40	242 :26	1950	250	DUMMY TEST	87 100	113 74	100 115	116 120	92 112	111 112	96 110	104 106	107 104	12 11
1/18	13:10	242:56	1950	250	DUMMY TEST	88 100	113 75	100 115	116 121	92 112	111 112	96 110	103 106	107 103	12 11
1/18	13:40	243:26	1950	250	DUMMY TEST	88 100	113 75	100 115	116 121	91 112	111 112	95 110	103 106	107 104	12 11
1/18	14:10	243:56	2400	250	DUMMY TEST	89 101	113 76	101 117	117 122	93 114	113 114	97 112	105 108	108 106	13 11
1/18	14:40	244:26	2400	250	DUMMY TEST	89 101	114 76	102 117	118 122	93 114	113 115	97 113	106 109	109 106	13 11
1/18	15:10	244:56	2400	250	DUMMY TEST	89 101	114 76	102 117	118 122	94 114	114 114	98 112	106 109	109 106	13 11
1/18	15:40	245 :26	2400	250	DUMMY TEST	89 101	114 76	102 117	117 122	94 114	114 115	98 113	106 108	109 106	13 11
1/18	16:10	245:56	2400	250	DUMMY TEST	89 101	114 76	101 117	117 122	93 114	113 114	97 112	105 109	109 106	13 11
1/18	16:40	246 :26	2700	250	DUMMY TEST	89 101	114 76	101 118	118 123	94 115	114 115	98 114	106 110	110 108	13 11
1/18	17:10	246:56	2700	250	DUMMY TEST	88 101	114 76	101 118	118 123	94 115	114 115	98 114	106 110	110 108	13 11

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA;LA

TEMPERATURE (°C)

5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
92	112	96	103	107	128	96	100	86	87	87	100	82	81	85	77	80	75	79	83	80	72	76
111	110	109	105	102	113	112	102	73	97	105	103	90	87	85	80	81	80	90	82	85	82	81
92	111	96	104	107	128	96	100	86	87	87	100	82	80	86	78	81	75	80	86	80	71	71
112	112	110	106	104	113	112	103	73	98	107	103	91	88	88	81	84	82	92	85	87	85	82
92	111	96	103	107	129	96	100	86	87	87	100	82	80	86	78	81	75	80	86	80	71	71
112	112	110	106	103	114	112	103	73	98	107	104	92	89	88	81	84	81	92	83	88	85	83
91	111	95	103	107	128	95	99	85	87	86	98	81	80	85	77	80	75	79	86	80	70	70
112	112	110	106	104	114	112	103	74	98	107	104	91	89	88	81	84	81	92	[illegible]	88	76	82
93	113	97	105	108	130	97	101	86	88	88	101	83	81	87	86	89	78	82	89	82	75	71
114	114	112	108	106	115	114	105	75	100	110	106	93	90	90	84	86	85	95	86	90	89	84
93	113	97	106	109	130	98	102	87	88	89	101	83	81	87	82	85	79	83	90	82	75	72
114	115	113	109	106	115	115	106	75	100	110	106	93	91	91	85	88	85	95	86	91	90	84
94	114	98	106	109	131	98	102	87	89	89	102	83	81	88	83	83	79	82	89	82	75	72
114	114	112	109	106	116	115	106	75	100	110	106	93	90	90	85	88	85	96	86	90	89	84
94	114	98	106	109	131	98	102	87	89	89	102	83	81	88	83	83	79	82	90	82	75	72
114	115	113	108	106	116	115	106	75	100	110	106	93	90	90	85	88	85	95	86	91	89	85
93	113	97	105	109	130	98	101	87	88	88	101	83	81	87	83	83	79	82	89	82	74	71
114	114	112	109	106	116	115	106	76	100	110	106	93	90	90	85	88	85	95	86	91	89	84
94	114	98	106	110	132	99	102	88	89	90	104	84	81	89	85	84	82	85	91	83	79	72
115	115	114	110	108	117	116	107	77	101	112	107	94	91	92	87	90	87	98	88	92	91	85
94	114	98	106	110	132	99	102	87	89	90	104	83	81	89	85	84	82	85	91	83	79	72
115	115	114	110	108	117	116	107	76	101	112	107	94	91	92	87	90	87	98	88	92	91	85

TA:LABORATORY BACK-TO-BACK TEST (SHEET 52)

E (°C)

27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	F TOTAL
76	65	64	51	40	53	45	79	67	80	75	89	78	75	54	75	72	63	78	71	71	26	20.1
81	71	77	77	71	72	73	85	69	87	90	87	95	79	69	70	77	60	85	77	71		22.8
71	63	62	49	38	51	42	77	65	77	71	86	76	71	54	70	68	60	76	67	68	24	20.1
82	72	78	78	71	71	73	86	71	88	92	88	101	81	70	70	79	63	86	78	72		22.8
71	63	61	48	38	50	41	77	65	77	71	86	76	72	53	71	68	60	76	68	68	25	20.1
83	72	78	79	72	72	74	87	71	89	92	89	96	81	71	71	79	68	87	78	73		22.8
70	63	61	48	37	50	41	77	65	76	70	85	75	70	52	70	68	59	75	68	67	25	20.1
82	72	78	78	71	71	74	87	71	89	92	89	103	81	70	71	79	66	87	78	72		22.8
71	63	62	49	38	51	42	77	65	77	71	87	76	72	53	71	68	61	76	68	68	25	20.4
84	73	79	79	73	73	75	88	72	90	92	90	100	82	71	71	80	71	88	80	73		23.1
72	64	63	50	40	53	45	78	66	78	72	88	76	72	55	72	69	61	77	69	69	26	20.8
84	74	79	80	74	74	76	89	73	90	93	90	101	82	73	73	80	71	89	81	74		22.8
72	64	63	50	41	53	45	78	66	78	72	88	77	72	54	73	70	62	77	69	69	26	20.4
84	74	79	80	73	73	76	89	73	90	92	90	101	82	73	72	80	65	89	80	74		23.1
72	64	63	50	41	53	45	78	66	78	72	88	77	73	55	72	70	61	77	69	69	26	20.4
85	74	79	80	74	74	76	89	74	91	9[illegible]	91	102	83	73	73	80	70	89	80	74		23.1
71	63	62	49	39	51	[illegible]3	77	66	78	71	87	76	72	54	71	69	61	76	69	68	26	20.4
84	74	79	80	74	74	75	89	73	90	93	90	101	82	72	72	80	67	89	80	74		22.8
72	63	62	49	38	51	42	78	66	78	71	89	77	72	55	71	69	61	77	69	68	24	20.4
85	74	79	80	74	74	76	90	73	90	92	91	103	82	74	72	80	68	90	81	75		23.1
72	63	62	49	38	51	42	78	66	78	71	88	77	72	55	71	68	61	77	69	68	24	20.4
85	74	80	80	74	74	77	90	73	91	93	91	103	84	74	73	81	71	90	81	76		23.1

ST (SHEET 52)

											PUMP			MANIFOLD PRESS			DUMMY INPUT PRESS	
											FLOW							
38	39	40	41	42	43	44	45	46	47	48	TOTAL	ROLLER	PRESS	MAIN	L/H	R/H	L/H	R/H
89	78	75	54	75	72	63	78	71	71	26	20.1		70	42	40	36	21	18
87	95	79	69	70	77	60	85	77	71		22.8	5.5	66	44	38	36		
86	76	71	54	70	68	60	76	67	68	24	20.1		70	42	40	36	21	18
88	101	81	70	70	79	63	86	78	72		22.8	5.5	66	44	38	36		
86	76	72	53	71	68	60	76	68	68	25	20.1		70	42	40	36	21	18
89	96	81	71	71	79	68	87	78	73		22.8	5.5	66	44	38	36		
85	75	70	52	70	68	59	75	68	67	25	20.1		70	42	40	36	21	18
89	103	81	70	71	79	66	87	78	72		22.8	5.5	66	44	38	36		
87	76	72	53	71	68	61	76	68	68	25	20.4		70	42	40	36	21	18
90	100	82	71	71	80	71	88	80	73		23.1	5.5	66	44	38	36		
88	76	72	55	72	69	61	77	69	69	26	20.8		70	42	40	36	21	18
90	101	82	73	73	80	71	89	81	74		22.8	5.5	66	44	38	36		
88	77	72	54	73	70	62	77	69	69	26	20.4		70	42	40	36	21	18
90	101	82	73	72	80	65	89	80	74		23.1	5.6	66	44	38	35		
88	77	73	55	72	70	61	77	69	69	26	20.4		69	42	40	36	21	18
91	102	83	73	73	80	70	89	80	74		23.1	5.6	66	43	38	35		
87	76	72	54	71	69	61	76	69	68	26	20.4		69	42	40	36	21	18
90	101	82	72	72	80	67	89	80	74		22.8	5.5	66	43	38	35		
89	77	72	55	71	69	61	77	69	68	24	20.4		70	42	40	36	21	18
91	103	82	74	72	80	68	90	81	75		23.1	5.6	66	43	38	36		
88	77	72	55	71	68	61	77	69	68	24	20.4		70	42	40	36	21	18
91	103	84	74	73	81	71	90	81	76		23.1	5.6	66	43	38	36		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9	10	11
						Start on power at 17:50										
1/18/73	18:20	247:26	1950	250	DUMMY	86	112	99	115	89	109	94	102	105	126	94
					TEST	98	72	113	119	110	109	108	104	101	111	110
1/18	18:50	247:56	1950	250	DUMMY	86	112	98	115	90	110	94	102	106	127	94
					TEST	97	71	114	119	109	110	108	104	102	112	110
						Stop check sump strainers on dummy box										
1/18	20:05	248:26	1950	250	DUMMY	85	112	98	115	90	110	95	103	107	127	95
					TEST	96	70	114	119	109	109	108	104	101	110	110
1/18	20:35	248:56	1950	250	DUMMY	85	112	98	115	90	111	95	103	107	128	95
					TEST	97	70	113	119	109	110	108	104	101	111	110
						Stop check sump strainers on dummy box										
1/19	00:30	249:26	1950	250	DUMMY	82	111	96	115	88	110	94	102	105	126	93
					TEST	96	69	114	120	110	111	109	105	102	112	110
1/19	01:00	249:56	1950	250	DUMMY	82	112	97	115	90	111	95	103	107	128	94
					TEST	96	68	113	119	109	110	108	104	101	111	110
1/19	01:30	250:26	1950	250	DUMMY	82	112	97	115	90	111	95	103	107	128	94
					TEST	96	68	112	119	109	109	108	103	101	111	110
1/19	02:00	250:56	1950	250	DUMMY	82	112	97	116	90	111	96	103	107	128	95
					TEST	95	67	113	119	108	108	106	103	100	110	109
1/19	05:55	250:56	1950	250	DUMMY	88	109	102	112	85	105	91	98	102	122	89
					TEST	100	75	112	118	107	104	102	101	98	109	108
1/19	06:25	251:26	1950	250	DUMMY	81	109	95	111	86	106	91	98	102	123	88
					TEST	98	71	117	122	113	114	112	109	106	115	115

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA: LABORATORY BACK-TO-BA

TEMPERATURE (°C)																								
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
94	98	84	85	85	97	80	78	83	75	79	72	77	83	78	70	68	60	59	49	37	48	43	75	63
110	100	71	95	104	101	89	85	85	78	81	78	88	80	84	82	79	68	74	74	68	69	70	83	68
94	98	85	85	86	98	80	78	84	76	79	73	78	84	78	69	69	60	58	48	36	46	42	75	63
110	101	71	96	105	102	89	86	85	79	82	79	89	81	85	83	80	69	74	75	69	69	71	85	69
95	99	85	85	86	98	81	79	85	77	80	74	79	85	79	70	70	59	58	48	36	47	42	76	63
110	100	70	95	105	101	88	85	85	78	81	78	88	82	84	82	79	68	73	74	68	68	69	83	67
95	99	86	85	86	98	81	79	85	76	80	74	79	85	79	70	69	60	59	49	37	48	43	76	63
110	100	70	95	105	101	89	85	85	78	81	79	88	86	85	82	79	68	74	74	68	68	70	84	68
93	97	82	83	85	97	80	78	82	75	78	72	77	83	78	69	69	58	57	47	35	46	41	75	62
110	101	72	97	106	103	90	86	86	80	82	80	90	85	87	85	81	70	76	77	68	69	71	85	68
94	99	84	84	87	99	81	80	84	77	80	74	79	85	80	70	70	60	58	48	36	47	42	76	63
110	100	70	95	105	101	89	85	85	79	81	79	89	83	84	82	79	67	68	74	67	67	69	84	67
94	99	84	84	87	99	81	80	84	77	80	74	79	85	80	70	70	60	58	48	36	47	42	75	63
110	100	70	94	105	101	89	85	85	79	80	79	89	82	85	82	80	68	68	74	67	67	69	84	67
95	99	85	84	87	99	81	80	85	78	80	74	79	86	80	70	70	59	58	48	36	47	42	76	63
109	99	69	94	104	100	87	85	84	78	80	78	88	85	83	81	78	66	71	72	65	66	68	82	66
89	93	79	87	81	94	77	76	79	70	76	68	72	76	75	66	70	73	70	57	44	59	48	76	68
108	99	68	93	100	99	86	81	80	73	75	73	83	75	76	72	74	66	70	69	70	56	59	79	59
88	94	81	81	82	95	75	74	79	71	75	68	72	78	74	64	65	56	55	45	34	45	40	71	59
115	105	75	99	108	105	92	89	89	83	86	83	93	86	89	87	84	74	78	76	70	73	74	87	71

CK TEST (SHEET 53)

36	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
75	68	83	73	68	50	67	64	56	73	65	65	22	19.8		70	42	40	36	21	18
85	89	85	94	77	67	67	74	68	83	75	69		22.8	5.4	66	44	38	36		
75	68	83	74	69	51	67	64	56	74	65	65	21	19.8		70	42	40	36	21	18
86	90	86	95	78	68	69	76	69	85	76	70		22.8	5.4	66	44	38	36		
76	68	85	75	69	52	67	65	56	75	65	65	19	19.8		70	42	40	36	21	18
84	88	85	94	76	67	66	73	65	83	74	68		22.8	5.4	66	44	38	36		
76	68	85	75	69	53	67	65	56	74	65	65	20	20.1		70	42	40	36	21	18
85	90	85	95	77	68	67	75	70	84	76	69		22.8	5.4	66	44	38	36		
75	66	83	74	68	53	65	62	54	74	63	64	16	19.8		69	41	39	36	21	18
85	88	87	96	76	69	66	73	71	85	75	69		22.5	5.4	66	43	38	35		
76	67	85	75	69	53	66	64	55	75	65	64	16	20.1		69	41	39	36	21	18
85	88	85	95	76	68	66	73	74	84	74	68		22.8	5.4	66	43	38	35		
75	67	85	75	69	53	66	64	55	75	65	64	16	20.1		69	41	39	36	21	18
85	89	85	95	75	67	66	73	74	84	74	68		22.8	5.4	66	43	39	35		
75	66	85	75	68	53	66	64	54	74	64	64	14	20.1		69	41	39	36	21	18
84	87	84	94	74	66	65	71	76	82	72	67		22.8	5.4	66	43	38	35		
77	80	81	75	76	48	75	72	65	74	73	73	33	19.5		70	42	40	36	21	18
79	80	80	89	71	72	69	70	52	79	70	66		22.5	5.3	66	44	38	35		
72	66	80	71	66	45	64	62	52	70	62	62	16	19.2		70	42	39	36	21	18
89	91	89	96	79	73	69	77	66	87	76	66		23.1	5.6	66	43	38	35		

DATE	TIME OF DAY	TOTAL TEST TIME	TOTAL INPUT H.P.	TAIL H.P.		1	2	3	4	5	6	7	8	9
1/19/73	06:55	251:56	1950	250	DUMMY TEST	81 100	108 72	95 121	112 126	85 118	106 119	91 117	98 114	102 110
1/19	07:25	252:26	1950	250	DUMMY TEST	81 98	109 72	95 117	113 123	86 115	106 115	[illegible] 113	98 109	102 107
1/19	07:55	252:56	1950	250	DUMMY TEST	82 98	111 70	96 117	114 122	87 114	108 115	92 113	101 109	104 107
1/19	08:25	253:26	1950	250	DUMMY TEST	82 98	111 70	96 117	114 122	88 114	109 115	93 113	101 109	104 107
1/19	08:55	253:56	1950	250	DUMMY TEST	82 98	111 70	96 117	114 122	88 114	109 114	93 113	101 109	105 107
1/19	09:25	254:26	2700	250	DUMMY TEST	83 96	112 70	97 116	116 120	90 112	112 113	96 111	103 107	107 105
1/19	09:55	254:56	2700	250	DUMMY TEST	83 97	112 70	97 115	116 120	90 112	112 112	96 111	104 107	107 105
1/19	10:25	255:26	2700	250	DUMMY TEST	84 98	113 71	97 116	117 121	91 113	113 114	97 111	105 109	10 10
1/19	10:55	255:56	2700	250	DUMMY TEST	84 98	113 72	99 117	117 122	92 114	113 114	97 112	105 109	10 10
						Stop increase tail load							on power	
1/19	11:35	256:11	3700	425	DUMMY TEST	90 100	114 76	103 115	118 120	94 113	116 111	99 110	107 107	11 10
						Stop decrease tail load							on power	
1/19	12:35	256:56	400	40	DUMMY TEST	99 107	116 75	101 115	113 132	89 112	107 114	92 110	99 111	10 10
						Stop End of bench test								

TABLE XXI. ROLLER GEAR TRANSMISSION TEST DATA:LABOR

TEMPERATURE (°C)

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
106	91	98	102	122	88	94	81	80	82	95	75	73	79	70	76	68	73	78	74	65	64	55	5[illegible]
119	117	114	110	120	119	110	80	103	113	110	98	95	95	89	92	89	99	98	94	93	90	79	8[illegible]
106	91	98	102	123	89	95	82	81	83	96	75	74	80	71	77	69	73	79	75	65	65	55	5[illegible]
115	113	109	107	116	115	105	76	100	110	107	94	91	91	85	87	85	95	90	91	90	85	76	80
108	92	101	104	125	91	97	82	82	84	97	77	76	81	73	77	70	76	81	77	67	66	56	5[illegible]
115	113	109	107	116	115	105	76	99	109	106	94	90	90	84	87	84	95	92	90	89	85	75	80
109	93	101	104	126	92	97	83	82	85	98	78	77	82	74	78	71	76	82	77	67	67	57	56
115	113	109	107	116	115	105	75	100	109	106	94	90	90	84	87	84	95	90	90	89	85	74	79
109	93	101	105	126	92	97	83	83	85	98	78	77	82	74	78	71	76	82	77	67	67	57	56
114	113	109	107	116	114	105	76	100	109	106	94	90	90	84	87	84	95	92	90	89	85	75	79
112	96	103	107	129	95	99	85	85	88	101	81	79	86	82	82	79	82	89	81	77	68	58	57
113	111	107	105	114	113	103	72	97	110	103	91	88	89	84	87	83	95	90	89	88	81	71	74
112	96	104	107	129	96	100	85	85	88	101	81	80	86	82	83	79	83	89	81	77	68	58	58
112	111	107	105	113	112	103	72	97	110	103	91	87	88	83	87	84	95	87	89	87	81	68	74
113	97	105	108	130	97	101	86	86	88	101	82	81	87	83	83	80	84	90	82	77	70	60	58
114	111	109	106	114	114	104	74	98	110	105	92	89	90	85	88	85	96	90	90	89	82	72	77
113	97	105	108	131	97	101	86	86	89	102	82	81	87	83	84	81	84	90	82	77	70	60	59
114	112	109	107	116	115	105	74	99	111	105	92	90	90	85	89	85	96	87	90	90	83	73	78
oad on power 11:20																							
116	99	107	110	132	98	103	86	90	91	102	85	84	88	86	87	83	86	92					
111	110	107	105	115	113	103	72	98	108	105	90	88	87	84	87	85	95	84					
oad on power at 11:50																							
107	92	99	103	120	90	96	83	84	83	96	80	78	80	70	76	67	73	78	74	65	69	60	58
114	110	111	107	115	115	105	77	100	105	105	95	92	89	82	85	84	93	85	88	87	86	75	78
est																							

RY BACK-TO-BACK TEST (SHEET 54)

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MA
33	44	40	70	58	70	64	79	70	64	44	61	59	51	69	60	60	15	19.2		70	42
76	78	79	93	77	94	94	94	93	84	79	74	81	69	92	79	71		23.1	5.7	65	42
33	44	40	71	59	70	63	79	70	64	46	62	59	50	69	61	60	13	19.2		70	42
71	74	76	90	79	91	93	91	101	83	74	72	79	68	90	78	68		22.5	5.4	66	43
34	45	40	73	60	72	64	81	72	65	49	63	61	52	71	62	61	14	19.5		69	41
71	74	76	90	73	91	93	91	100	82	74	71	79	71	89	77	68		22.5	5.4	65	42
34	46	41	73	60	73	65	82	72	66	49	64	61	52	72	62	61	14	19.2		69	41
70	73	76	89	72	90	93	90	100	82	73	70	79	69	89	77	67		22.5	5.4	65	42
34	46	41	73	61	73	65	82	72	66	49	64	62	52	72	62	62	14	19.2		69	41
70	74	76	89	73	90	93	90	100	81	73	71	78	72	89	77	68		22.5	5.4	65	42
35	46	41	74	62	74	66	86	73	57	52	54	62	54	73	63	63	15	19.8		69	42
68	70	71	85	70	87	90	87	99	80	69	70	77	66	85	75	66		22.5	5.3	66	43
36	47	42	75	62	74	66	86	74	68	52	66	64	54	73	63	63	15	19.8		69	42
68	70	71	85	70	87	90	87	99	79	69	69	76	68	85	75	66		22.2	5.3	66	43
36	47	42	75	63	75	68	87	75	69	53	65	64	55	75	65	64	17	19.8		69	42
69	72	73	87	71	89	91	89	100	80	71	70	77	63	86	77	70		22.2	5.4	66	43
38	49	44	76	64	76	68	87	75	69	54	66	64	56	75	66	65	18	19.8		69	42
70	72	74	87	72	89	92	89	101	80	71	71	78	65	87	77	68		22.2	5.4	66	43
																		20.7		70	42
																		22.2	5.3	66	43
36	47	42	73	63	73	69	80	72	69	50	67	65	56	72	65	65	23	19.5		69	41
71	73	75	90	74	91	94	91	98	84	76	77	81	59	90	79	77		21.5	5.4	65	42

SHEET 54)

39	40	41	42	43	44	45	46	47	48	PUMP FLOW TOTAL	PUMP FLOW ROLLER	PUMP PRESS	MANIFOLD PRESS MAIN	MANIFOLD PRESS L/H	MANIFOLD PRESS R/H	DUMMY INPUT PRESS L/H	DUMMY INPUT PRESS R/H
70	64	44	61	59	51	69	60	60	15	19.2		70	42	39	36	21	18
93	84	79	74	81	69	92	79	71		23.1	5.7	65	42	37	35		
70	64	46	62	59	50	69	61	60	13	19.2		70	42	40	35	21	18
101	83	74	72	79	68	90	78	68		22.5	5.4	66	43	38	35		
72	65	49	63	61	52	71	62	61	14	19.5		69	41	39	35	21	18
100	82	74	71	79	71	89	77	68		22.5	5.4	65	42	37	35		
72	66	49	64	61	52	72	62	61	14	19.2		69	41	49	35	21	18
100	82	73	70	79	69	89	77	67		22.5	5.4	65	42	37	35		
72	66	49	64	62	52	72	62	62	14	19.2		69	41	39	35	21	18
100	81	73	71	78	72	89	77	68		22.5	5.4	65	42	37	35		
73	57	52	54	62	54	73	63	63	15	19.8		69	42	40	36	21	18
99	80	69	70	77	66	85	75	66		22.5	5.3	66	43	38	35		
74	68	52	66	64	54	73	63	63	15	19.8		69	42	40	36	21	18
99	79	69	69	76	68	85	75	66		22.2	5.3	66	43	38	35		
75	69	53	65	64	55	75	65	64	17	19.8		69	42	40	36	21	18
100	80	71	70	77	63	86	77	70		22.2	5.4	66	43	38	35		
75	69	54	66	64	56	75	66	65	18	19.8		69	42	40	36	21	18
101	80	71	71	78	65	87	77	68		22.2	5.4	66	43	38	35		
										20.7		70	42	40	36	21	19
										22.2	5.3	66	43	38	35		
72	69	50	67	65	56	72	65	65	23	19.5		69	41	39	35	20	18
98	84	76	77	81	59	90	79	77		21.5	5.4	65	42	37	35		

APPENDIX II

ULTRASONIC INSPECTION

The electron beam welds of the roller gear drive components were inspected by the pulse-echo ultrasonic inspection technique. This technique employs ultrasonic energy in the range of .25 - 25 MHz to detect flaws. This range is used because wavelengths of energy in this frequency range are of the same order of magnitude as the flaws in the welds.

The principle of pulse-echo ultrasonic inspection is depicted schematically in Figure 123. A short burst of ultrasonic energy is emitted from the piezoelectric crystal. When the pulse reaches surface "A" of the test specimen, a portion of the energy is reflected, due to an acoustic impedance mismatch, back to a pickup and displayed on the oscilloscope as the trace labeled "A" in Figure 123. The portion of the pulse not reflected from surface "A" continues through the material until it reaches the defect "Y" where the pulse is again reflected and displayed on the oscilloscope as trace "B". The remainder of the wave passes through the material and is reflected off the back surface and recorded as trace "C".

By drilling a flat bottomed hole of known depth and diameter in a sample similar to the specimens to be tested and performing an inspection on it, the ultrasonic inspection technique can be calibrated so that both depth and size of voids can be determined.

The particular method used for inspection of the electron beam welds of the roller gear components is known as the full-immersion technique. In this method, the test specimen is fully immersed in water containing a wetting agent. The water acts as a conduction of the ultrasonic waves, thus eliminating the need for the probe to be in physical contact with the test specimen. This method allows automation to be employed in the inspection and produces more consistent results than the contact method. The equipment used for the inspection of the roller gear drive components is pictured in Figures 124 and 125. A schematic showing inspection of a first-row pinion is shown in Figure 126. The waveform at the bottom represents an actual waveform resulting from the inspection. The peak at the left represents the inner wall. The smaller peak in the center represents a void in the weld, while the peak on the right represents the outer wall of the component.

As a direct result of the experiences in this program, the following inspection procedure was developed.

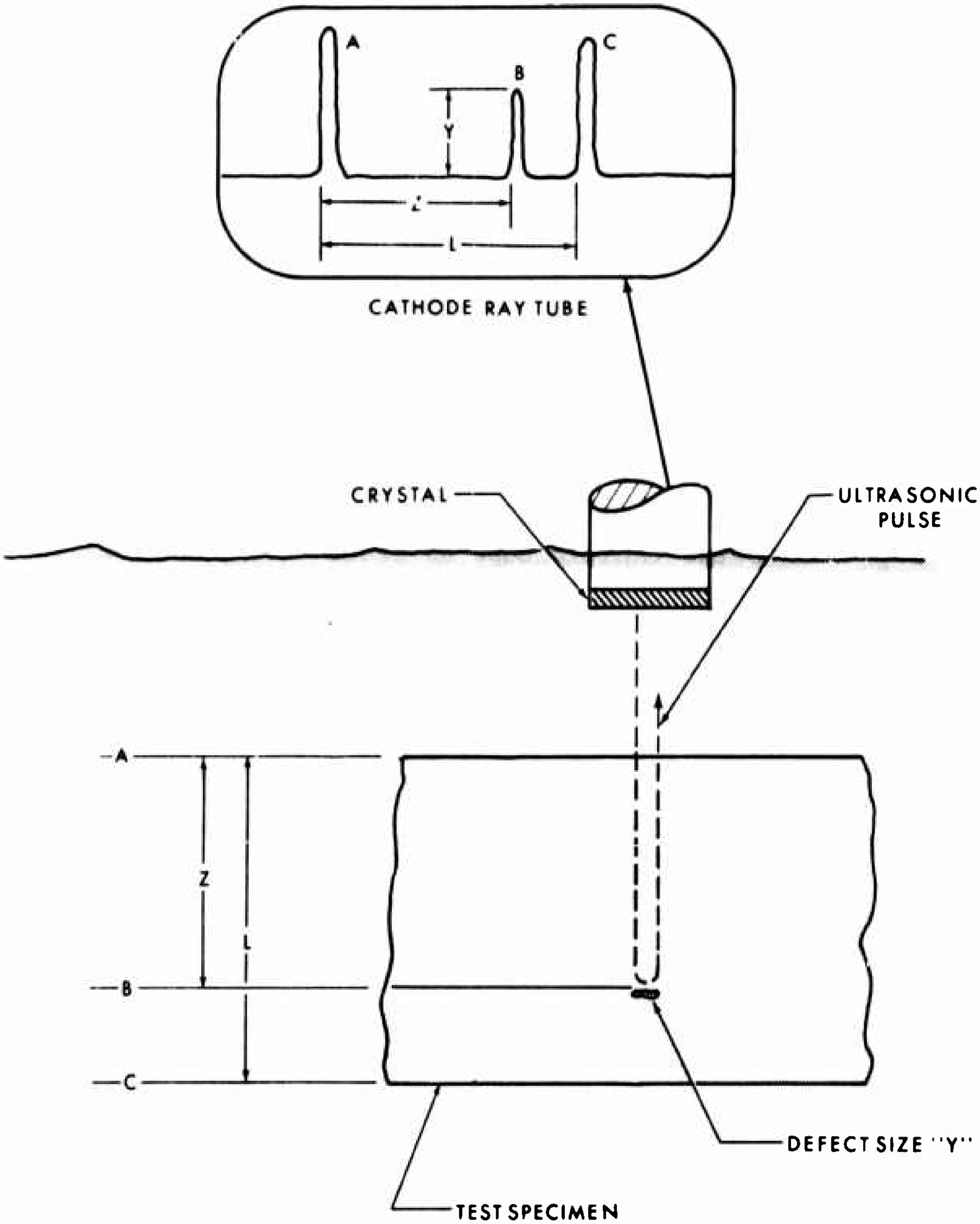

Figure 123. Schematic - Pulse-Echo Ultrasonic Inspection.

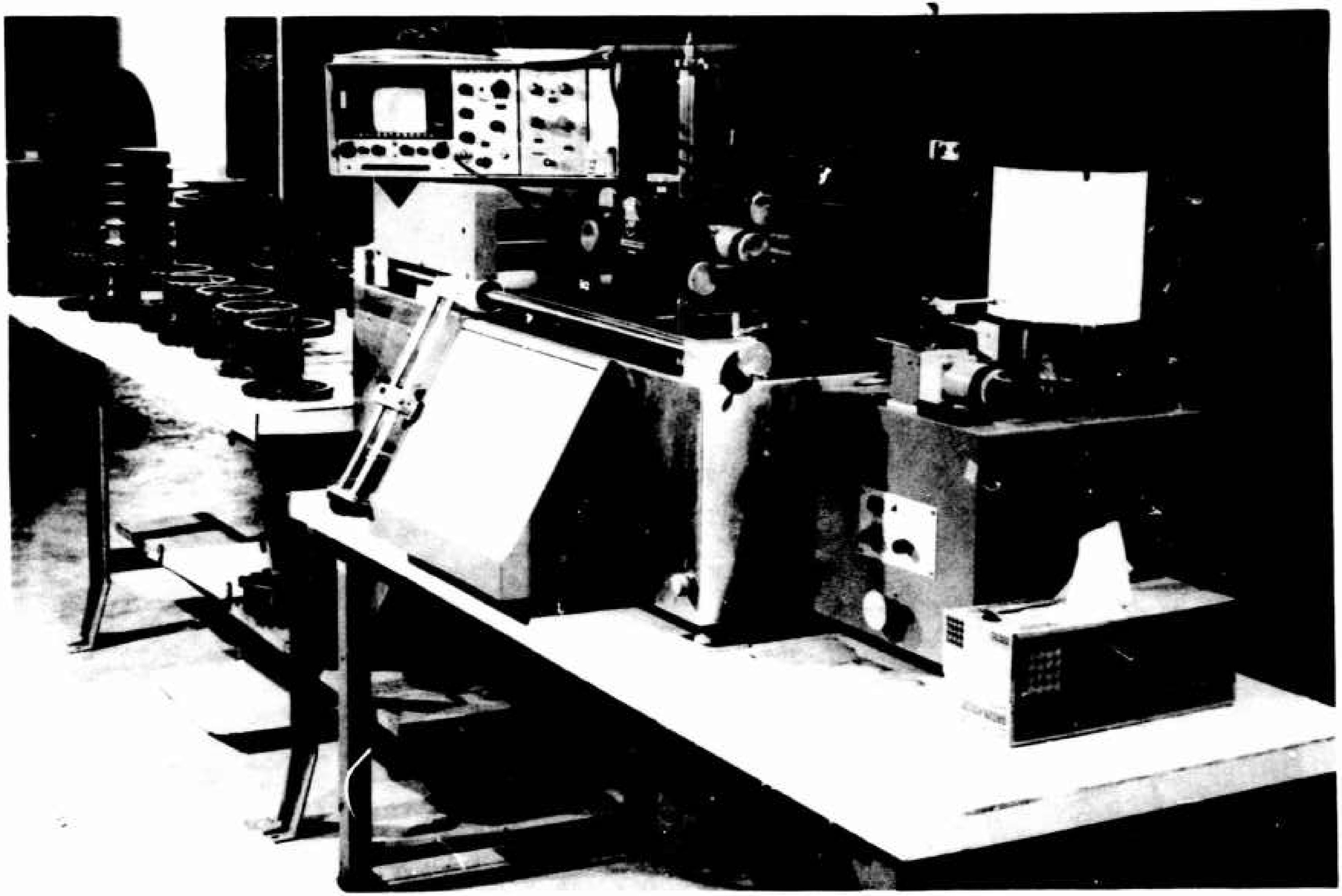

Figure 124. Ultrasonic Inspection Equipment.

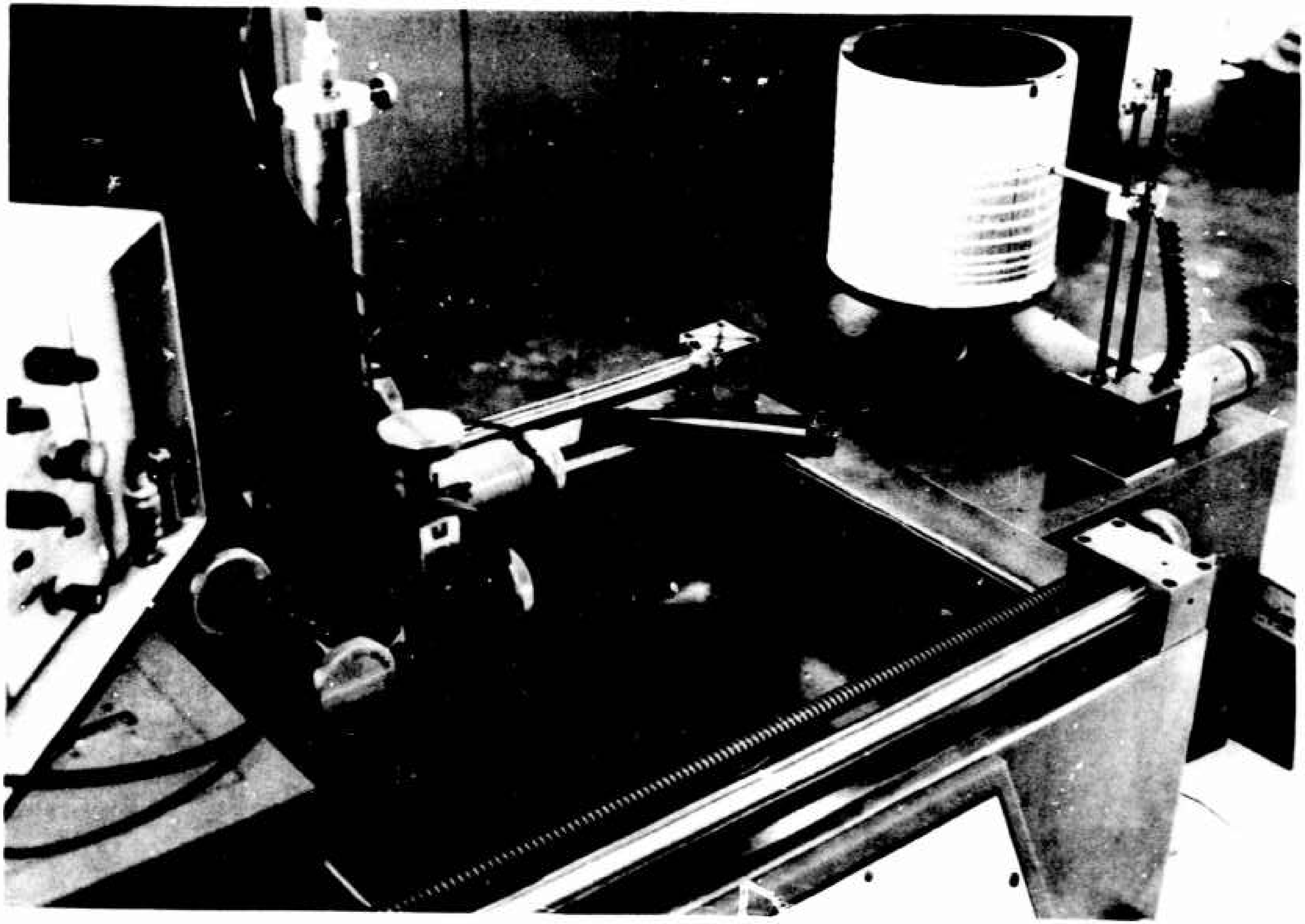

Figure 125. Ultrasonic Inspection Test - Second-Row Pinion.

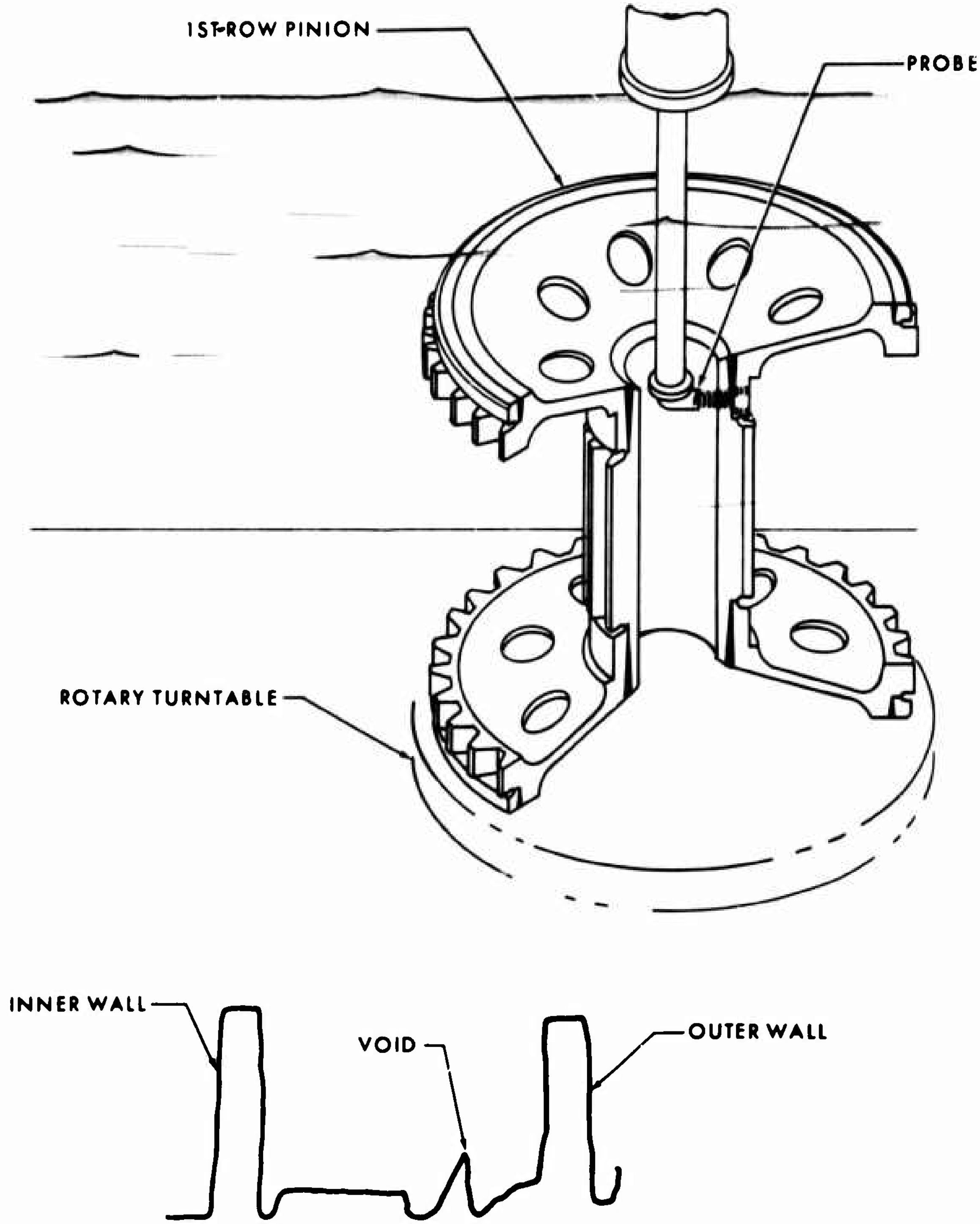

Figure 126. Schematic - Ultrasonic Inspection, First-Row Pinion.

Ultrasonic Inspection of Electron Beam Welded Gears

Scope

This procedure covers the requirements for conducting ultrasonic inspection tests by the immersion method and in accordance with Reference 5 to determine the presence of internal discontinuities in the electron beam welds currently used in the manufacture of roller gear drive components.

The procedure is applicable for the following components.

(a)	RG351-11181	Second-Row Pinion Gear 4.061 inches dia. weld 5.755 inches dia. weld 6.121 inches dia. weld 9.031 inches dia. weld
(b)	RG351-11182	First-Row Pinion Gear 5.515 inches dia. weld 1.710/1.000 inches dia. butt weld
(c)	RG351-11183	Sun Gear 8.392 inches dia. weld

The standards for acceptance of defects detected by ultrasonic inspection shall be as specified on the drawings.

Requirements

The equipment used shall be an automated system with C-scan capability such as Sperry SR-154 or US-454.

The electronic equipment used shall be a Sperry Reflectoscope UM721 or UM771 with a 10-N Pulser/Receiver and a Fast Transigate.

The search unit shall be suitable for immersion inspection.

The search unit for the diametral welds shall be Lithium Sulfate, 0.25 inch diameter, medium focus 10 MHz, #57A-2766.

The search unit for the butt welds (RG351-11182) shall be a J type, 0.25 inch flat focus, #J385-SIJ-10 MHz.

The calibration standard shall be representative of the test sample, particularly at the entry surface with regard to curvature and surface condition.

For the diametral welds listed, the calibration standard shall be as shown in Figure 127.

The butt weld (RG351-11182) calibration standard shall be as shown in Figure 128.

Calibration

The calibration standard with the curvature and entry surface condition similar to the production part being tested shall be calibrated as follows:

Calibration for the diametral welds - the amplitude of the 0.020-inch-diameter test hole shall be set at 2 inches and the gate set to alarm at 90 percent of the test hole amplitude.

Calibration for the butt weld requires two "setups".

1. To determine voids equal to or greater than the response from a 0.020-inch-diameter test hole. The amplitude of the 0.020-inch-diameter test hole shall be set at 1.8 inches and the gate set to alarm at 90 percent of the test hole amplitude.

2. To determine voids equal to or greater than the response from a 0.013-inch-diameter test hole. With the amplitude of the 0.020-inch-diameter test hole set at 1.8 inches (the 0.013-inch test hole amplitude is 0.75 inch), the gate shall then be set to alarm at 90 percent of the 0.013-inch test hole amplitude.

Procedure

For each different type of gear and direction of scanning the corresponding calibration standard C-scan is required.

The surface from which the test is to be performed shall be clean and free from dirt, grease and scale.

Upon the component being immersed in the tank, all air bubbles shall be removed from the surface being tested.

The search unit shall be maintained normal to the test surface, with the search unit positioned as shown in Figures 129, 130, and 131.

The weldments shall be inspected at 10 MHz.

Complete coverage of the weld area shall be accomplished by indexing after each complete scan. The transducer shall be moved in such manner that each scan overlaps the previous pass by at least 25 percent of the effective beam diameter.

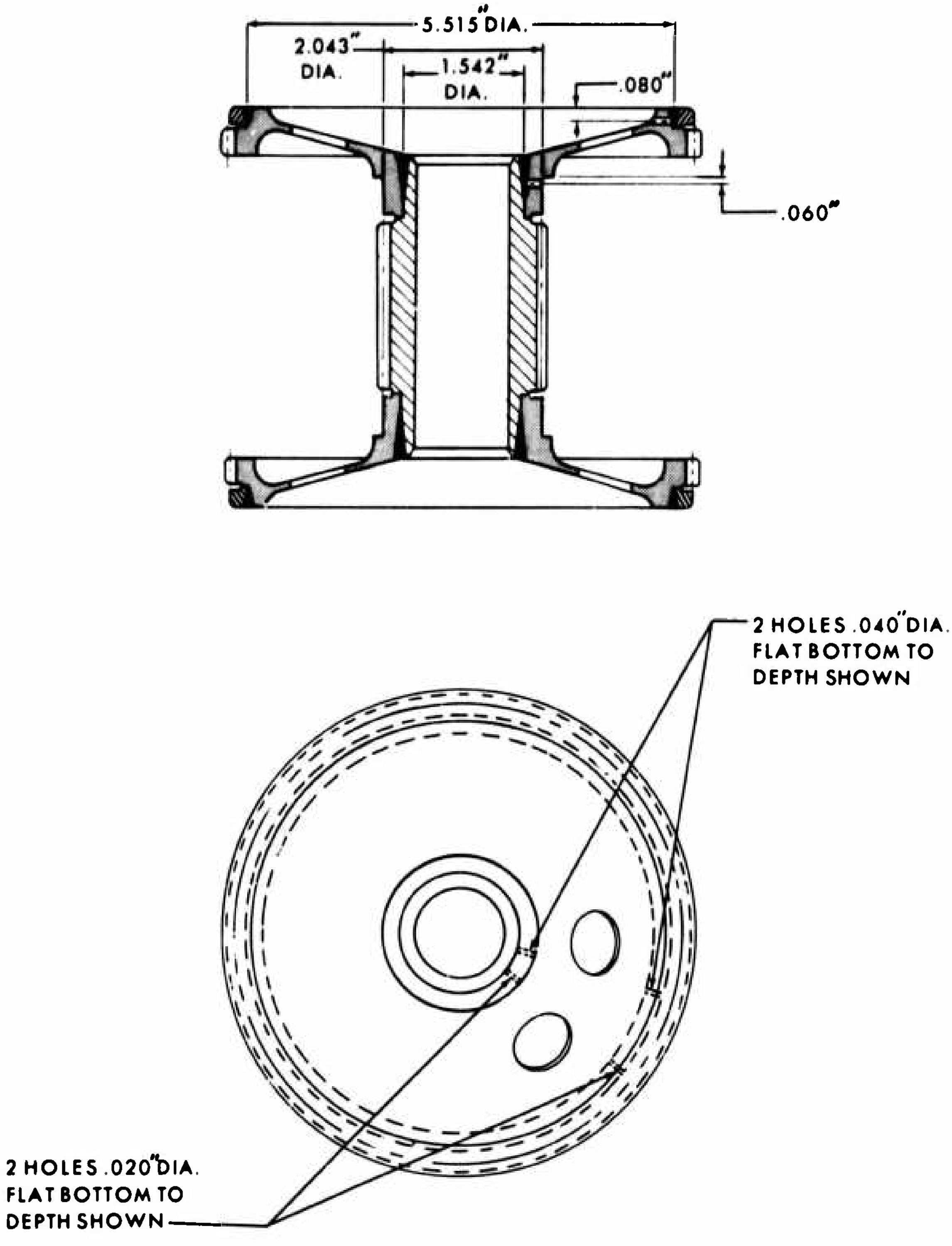

Figure 127. Calibration Standard - Diametral Weld,

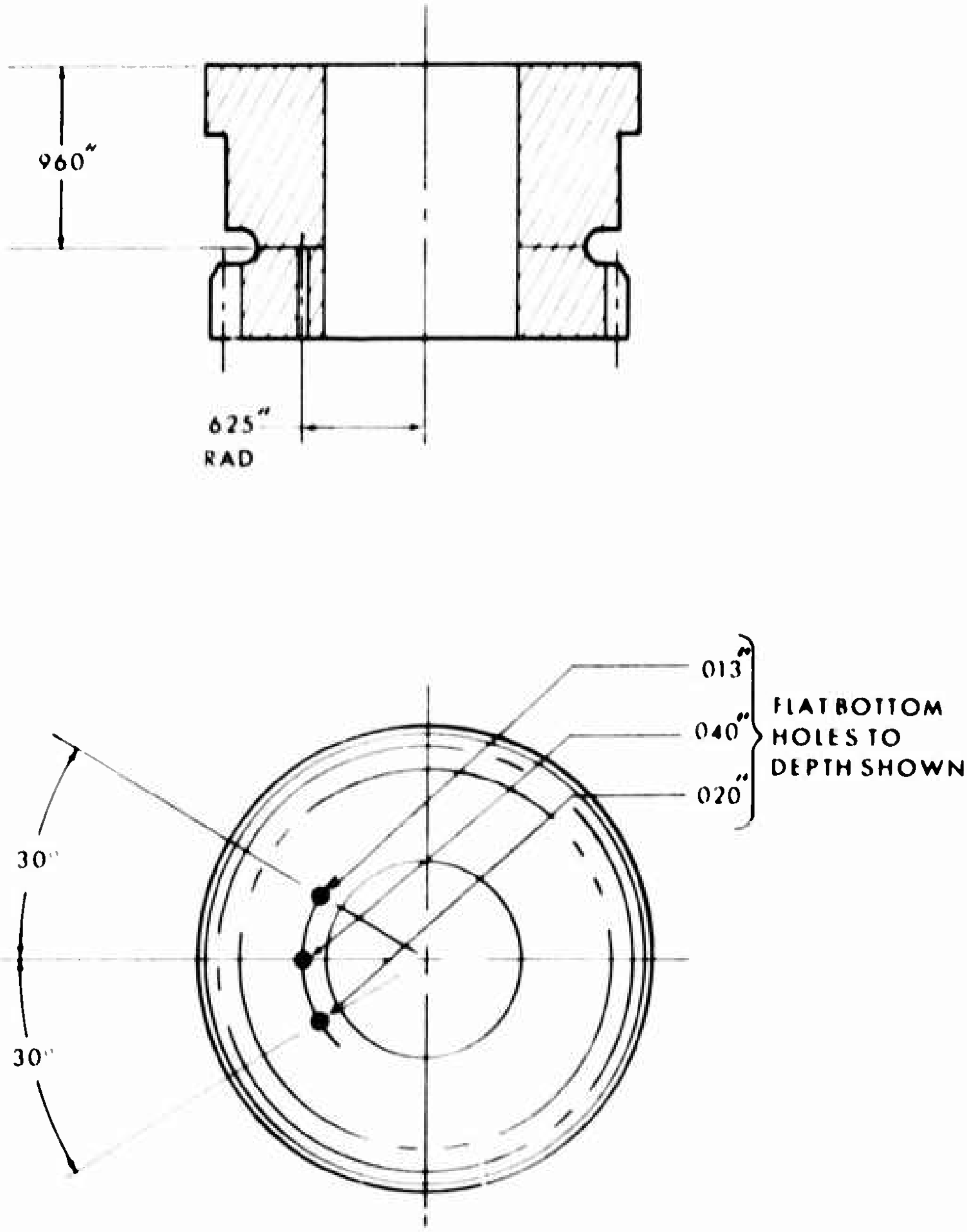

Figure 128. Calibration Standard - Butt Weld.

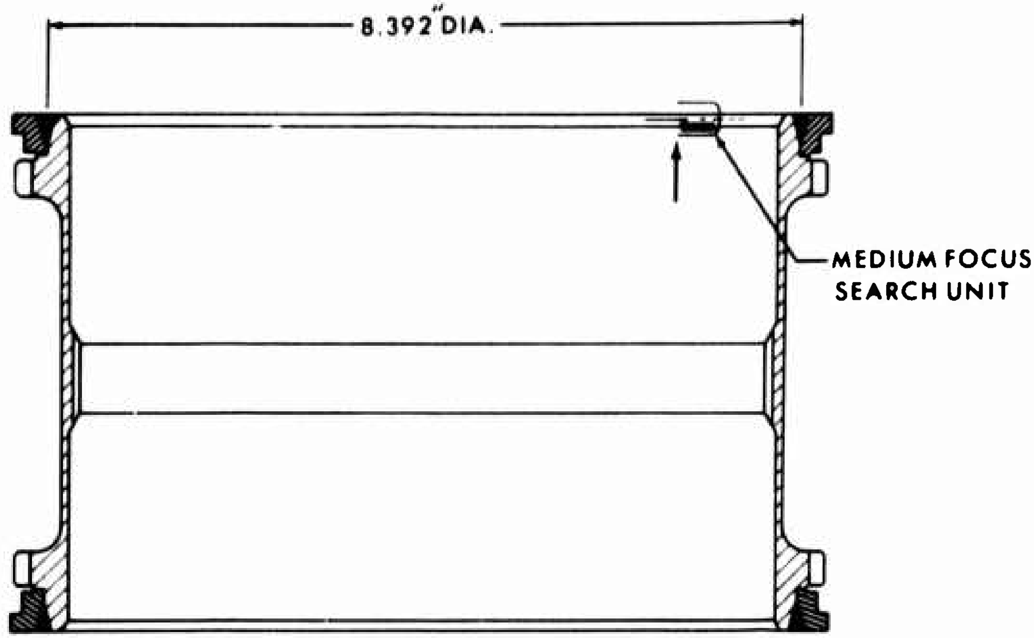

Figure 129. Sun Gear - Ultrasonic Inspection

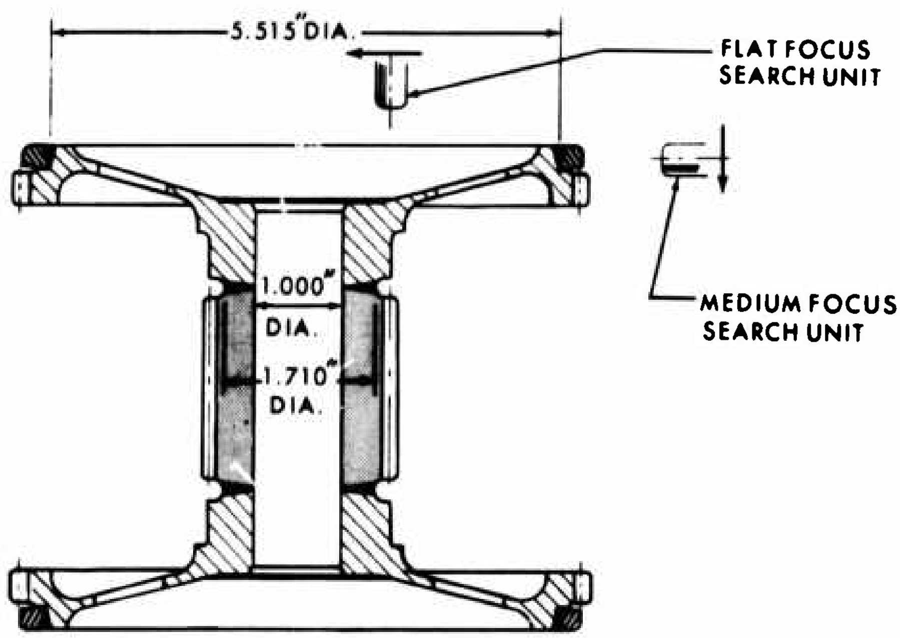

Figure 130. First-Row Pinion - Ultrasonic Inspection.

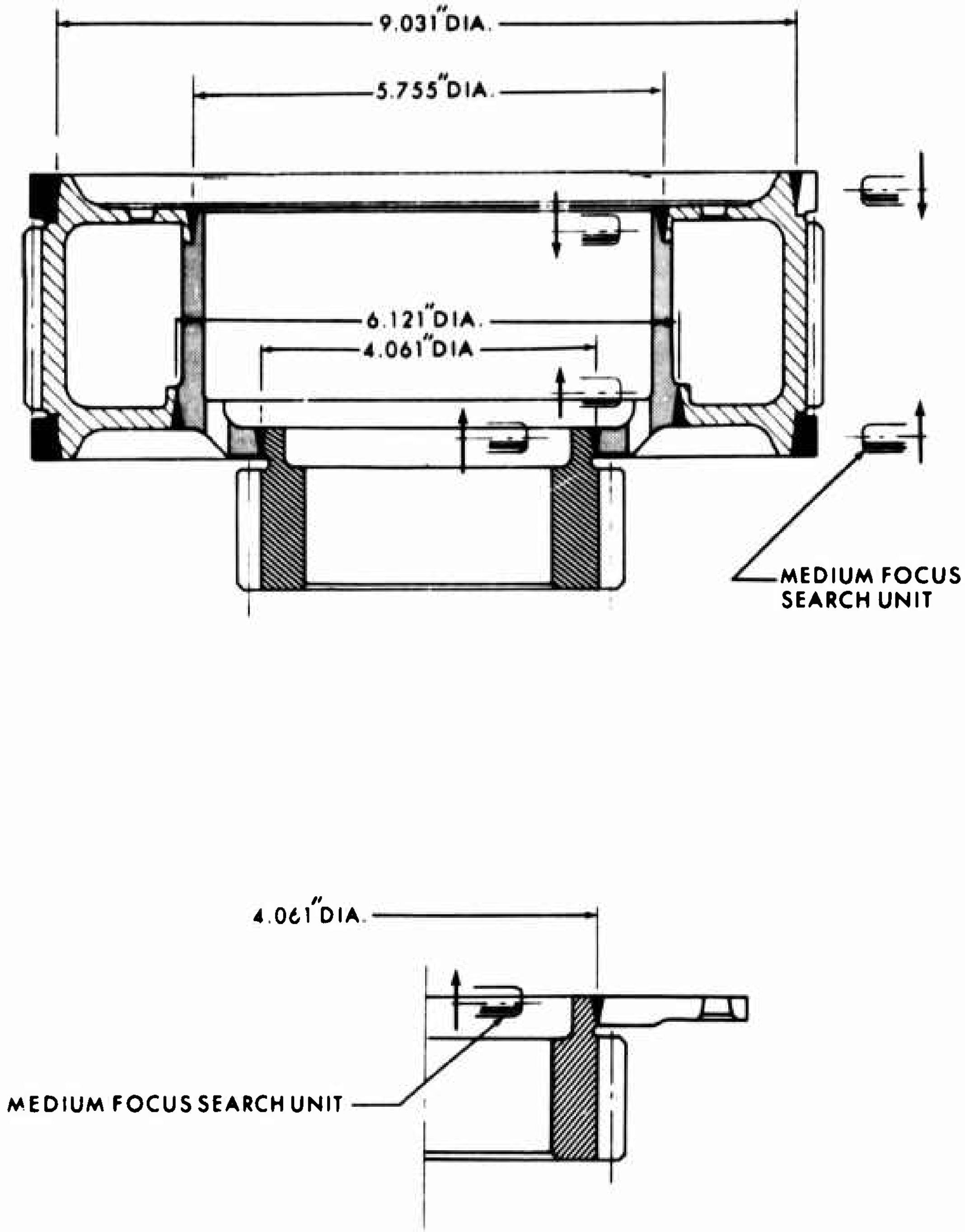

Figure 131. Second-Row Pinion - Ultrasonic Inspection.

The start position of scanning shall be indicated on the C-scan and marked on the gear with the direction of rotation.

A C-scan recording shall be made each time the calibration standard is run.

The production parts shall be run under the same conditions as the calibration standard, and a C-scan shall be made for each weld.

The C-scan shall be positively identified with the serial number of the production part and the appropriate weld.

All C-scans of the butt weld RG351-11182 shall be of a scale equal to twice the actual weld diameter (i.e., the C-scan weld outside diameter shall be 3.4 inch).

All C-scans of the diametral welds shall be recorded on an 8-inch-diameter drum.